FINAL
Source Area Investigation and Study

Former J.H. Baxter & Co. Wood Treating Facility
Arlington, Washington

Prepared for:

U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101

Submitted by:

J.H. Baxter Team
P.O. Box 10797
Eugene, OR 97440

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Prepared by:

GSI Water Solutions, Inc.
55 SW Yamhill Street, Suite 300
Portland, OR 97204
P: 503.239.8799
info@gsiws.com
www.gsiws.com

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Abbreviations and Acronyms

AOC	Administrative Order of Consent
Apex	Apex Laboratories, LLC.
ASTM	American Society for Testing M
Baxter	J.H. Baxter and Co.
bgs	below ground surface
BOD	Biological oxygen demand
cm	centimeters
cm^3	cubic centimeters
CFR	Code of Federal Regulations
CMS	corrective measures study
COC	chain-of-custody
COI	chemicals of interest
DNAPL	dense non-aqueous phase liquid
Ecology	State of Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
Fe	Ferrous iron
FSO	field safety officer
g	gram
GSI	GSI Water Solutions, Inc.
HAZWOPER	Hazardous Waste Operations and Emergency Response
HASP	health and safety plan
IDW	investigation derived waste
kg	kilogram
L	liter
LNAPL	light non-aqueous phase liquid
MDL	method detection limit

mg	milligram
mm	millimeter
NAPL	non-aqueous phase liquid
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCP	pentachlorophenol
PM	project manager
QA	quality assurance
QAM	quality assurance manual
QC	quality control
RCRA	Resource Conservation and Recovery Act
RDL	reported detection limit
RP	ReSolution Partners, LLC
SADMP	sampling analysis data management plan
Workplan	Source Area Investigation and Study Workplan
Site	J.H. Baxter & Co. Wood Treating Facility
SOP	standard operating procedure
TCLP	Toxicity characteristic leaching procedure
TM	task manager
TOC	total organic carbon
TOD	total oxidant demand
TPH	total petroleum hydrocarbons
WSDOT	Washington State Department of Transportation
wt	weight

1. Introduction

The J.H. Baxter Project Team, consisting of J.H. Baxter & Co. (Baxter) and GSI Water Solutions, Inc. (GSI), has prepared this Draft Source Area Investigation and Study Work Plan (Workplan) for the former Baxter wood-treating facility located at 6520 188th Street NE in Arlington, Washington (Arlington facility or facility [Figure 1]). This Workplan has been prepared for the U.S. Environmental Protection Agency (EPA) to document planned approaches to evaluate additional source area remedial options for addressing pentachlorophenol (PCP) and oil-based wood treatment agent impacted soil and wood chips as part of the Corrective Measures Study (CMS) process. These CMS activities are consistent with guidance provided by EPA in the Resource Conservation and Recovery Act (RCRA) Corrective Action Plan (Final), dated May 1994 (EPA, 1994); the Corrective Action Advance Notice of Proposed Rulemaking (EPA, 1996); and the EPA Administrative Order of Consent (AOC) dated April 30, 2001 (EPA, 2001).

1.1 Background

The Site is identified by the State of Washington Department of Ecology (Ecology) as Facility Site ID No. 2709 and Cleanup Site ID No. 4768. The former J.H. Baxter wood-treating facility (Site) is currently operated by McFarland Cascade Holdings, Inc. (a Stella-Jones Company), and uses PCP as the primary wood treatment chemical. Numerous investigations and remedial activities have been completed at the facility since the 1990s. Comprehensive background information regarding the Facility's history and the nature and extent of chemicals of interest (COIs) in soil and groundwater are presented in the 2005 Site Investigation (SI) Report (Baxter, 2005a) and the CMS (GSI, 2017).

The SI and earlier investigations conducted in the 1990's identified both residual non-aqueous phase liquids (NAPL) and mobile NAPL in the Main Treating Area (Figure 2) that contributes to a PCP groundwater plume extending downgradient of the source area. Several technologies were presented in the CMS (GSI, 2017) to reduce COI concentration and mass in the areas of residual and mobile NAPL in the Main Treating Area ("source areas"). A Remedial Action Pilot Study is considered to be part of the ongoing Corrective Measures Study (CMS; Baxter, 2011), which continues to be operating while source area remedial actions are being considered. An expansion of the pilot study recirculation system was selected in the CMS as the preferred alternative. This alternative, while anticipated to be effective at PCP reduction over time, will result in a longer time horizon to achieve cleanup goals. As such, during re-engagement with EPA on the CMS starting in May 2021, GSI proposed the consideration of a potential alternative that proposes excavation of source area contaminants (where capable of removal) and construction of an ex situ pile to treat the source area materials and reduce concentrations of PCP below listed waste concentrations. EPA requested GSI expand this concept into a source area investigation Workplan. This document represents the Workplan approach.

All work will be completed in accordance with industry standard practices. Drilling, sampling, and laboratory analysis activities for both soil and groundwater will be conducted in accordance with the existing Sampling Analysis Data Management Plan (SADMP) included as part of the 2002 Site Investigation Work Plan, Revision 2 (Baxter,

2002). All field activities will be conducting in accordance with a Facility-specific Health and Safety Plan (Attachment A).

1.2 Project Objectives

The purpose of this Workplan is to document the investigation tasks to acquire Facility-specific data to aid in the design and implementation of an ex situ treatment pile option for site remediation. The objectives of the investigation tasks are to collect sufficient data to evaluate the effectiveness of ex situ pile treatment as a remedial technology in the Main Treating Area (Figure 2). The results of this study will be used to support design and implementation of the final corrective measures to be implemented at the Facility.

Separately, while on site to collect bench study source material, Baxter will attempt to further refine source area extents of impacts under existing structures using angled borings.

1.3 Team Organization and Responsibilities

This Workplan will be implemented by GSI.

1.3.1 Project Manager

Josh Bale, P.E., is the project manager (PM). In this role, he will oversee the work and will be the point of contact for the GSI staff and the regulatory agencies. Josh will work closely with the task manager (TM), discussed below, and other project staff members to ensure that the project objectives are achieved. Principal deviations from the Workplan will not be made without prior approval from the PM. The PM generally is responsible for the following:

- Overseeing the planning and implementation of all field sampling efforts in accordance with this Workplan.
- Coordinating with Resolution Partners, LLC. (RP) who will conduct the setup, implementation, and data collection process for the Bench Study.
- Coordinating with the TM to address any field or laboratory problems, approve deviations from this Workplan, and resolve any emergencies that may arise.
- Communicating with Baxter and EPA regarding the schedule, performance, and any anticipated deviations from sampling and analysis activities.

1.3.2 Task Manager

Joe Sherrod, L.G., will serve as the TM for the sampling activities. He will report directly to the PM and coordinate with other project and/or subcontractor staff members. The TM generally is responsible for the following:

- Leading the planning and implementation of all field sampling efforts, including arranging for necessary sampling equipment and laboratory sampling containers.
- Mobilizing for field work and leading all aspects of the sampling to ensure that the appropriate procedures and methods are used in accordance with this Workplan.
- Coordinating closely with the PM and field staff members to address any field problems, deviations from this Workplan, or emergencies that may arise.
- Maintaining copies of field documentation and laboratory chain-of-custody (COC) forms.

- Functioning as the field safety officer (FSO) and ensuring that the sampling activities adhere to the Health and Safety Plan (HASP) (Attachment A) and are in general compliance with 29 Code of Federal Regulations (CFR) 1910.120.
- Tracking the schedule and performance of the sampling and analysis activities according to this Workplan in direct coordination with the PM.

The TM will work closely with the PM to fulfill the listed responsibilities and may be assisted at times by other project staff members.

1.3.3 Data Validation

James Mc Ateer of QA/QC Solutions, LLC will perform a quality assurance (QA) review of the analytical data, add qualifiers to the electronic data deliverables submitted by the laboratories, and incorporate the validated laboratory data into the project database.

1.3.4 Laboratory Services

Apex Laboratories, LLC (Apex), of Tigard, Oregon, will be the primary contract laboratory for all work and will (1) perform chemical analyses of field samples collected; (2) perform chemical analysis of bench study samples that are not performed by the study subcontractor;; (3) manage and dispose of sample matrices and any leachates; and (5) subcontract chemical analyses to other analytical laboratories, if needed. Philip Nerenberg will serve as the laboratory PM to oversee Apex's laboratory performance.

1.3.5 Bench Study

ReSolution Partners, LLC., of Madison, Wisconsin, will be the subcontractor performing all bench studies and will (1) setup and manage all bench studies; (2) perform chemical analysis of bench study samples, where capable; (3) collect data during study and process all data results; (4) manage and dispose of study matrices and any leachates; and (5) provide a summary report of overall findings. Kevin Baker will serve as the subcontractor PM to oversee the bench study performance.

2. Health and Safety

The TM will function as the FSO during the fieldwork and ensure that safe practices and operating conditions are maintained during the field investigation. The field crew will comply with Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations under CFR 1910.120. The TM will provide a safety briefing at the beginning of the field work, during sampling events as needed (e.g., when conducting new or different field activities), and to any new personnel involved in the field activities. In addition, the TM will perform routine safety checks of the bench study setup to ensure safe operations.

GSI prepared a HASP (Attachment A) in accordance with Occupational Safety and Health Administration (OSHA) regulations (29 CFR Part 1910). The HASP covers all known field hazards associated with the tasks necessary to complete this Workplan. All field personnel will have stop-work authority during the completion of field activities.

Field activities will involve work on an active wood treating facility. Extreme caution should be used when working in areas near active operations and cones and a spotter should be used, as appropriate, based on the volume of traffic.

3. Field Schedule and Sampling Summary

Samples will be collected from locations identified in the attached Figure 2 and Table 1. The sample locations include nine rotosonic drilling borehole locations that will be collected for lithologic characterization, laboratory chemical analysis, and to obtain matrix material for bench scale studies. Four of the proposed borings will be advanced vertically within the NAPL source area and five additional borings will be angled under site structures in proximity to the estimated area of NAPL extent. Analytical testing will be based on field determination based on lithologic logging for the angled borings and based on the details outlined in the bench studies (See Section 4 below) for the vertical borings but minimally will include polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), and PCP for untreated soil. Additional, pre- and post- bench study sampling will vary based on study objectives. Samples will be analyzed in accordance with methods identified in Tables 2 and 3.

To assess the effectiveness of the ex-situ treatment technology at the Facility and further define NAPL extents, we have developed a series of field tasks to determine the viability of incorporating this alternative into the CMS. The field tasks below are designed to build on the data generated by previous tasks. The proposed tasks include the following:

- **Task 1 - Collect Source Area Soil Data.** Collect additional soil data from the NAPL-affected source area under structures where data gaps on the extent of NAPL extents by advancing five boreholes from the edge of structures and on an angle to achieve penetration under structures. Perform continuous soil collection to allow for logging of subsurface soil characteristics. In addition, the field team will collect up to six representative soil samples from NAPL impacted zones for laboratory analysis. The boreholes will provide additional data within the source area to characterize geology and assess COI distribution.
- **Task 2 - Collect Source Area Materials for Bench Studies.** Collect additional soil data in locations identified during the NAPL study (Baxter, 2005b) that represent both the wood chip and the shallow subsurface soil matrix zones by advancing up to four boreholes at representative highly impacted source areas with varying source material characteristics (based on previous investigation boring logs). Within each of those matrices, samples would be collected for bench studies that contain denser, more viscous, relatively immobile NAPL (i.e. – highly degraded oils and creosote) and lighter, more mobile NAPL (i.e. – PCP cutting oils and degraded diesel) to determine bench study effects on differing source conditions. Perform continuous soil collection to allow for logging of subsurface soil characteristics and field determination of material to be collected for bench studies. The boreholes will also provide additional data within the source area to confirm geology and assess any changes to COI distribution.

4. Bench Study Schedule and Objective Summary

To assess the effectiveness of ex-situ treatment pile technologies at the Facility, we have developed a series of laboratory bench study tasks to determine the viability of incorporating this alternative into the CMS. The bench study tasks below are designed to build on the activities conducted in the field and previous studies to complete these tasks. The proposed tasks include the following:

- **Task 3 - Bench Testing of Source Area Soil.** Conduct bench testing of soil from the source areas to assess the effectiveness of options for ex-situ treatment, which include aerobic biological treatment, surfactant stripping of contaminants from solid matrices, and re-evaluation of chemical oxidation processes using Fenton's reagent.
- **Task 4 - Evaluation of Bench Scale Data and Design of Pilot Test.** Compile and evaluate data from the supplemental soil sampling in the source areas, as well as the bench tests. Determine approximate costs of varying ex-situ approaches and anticipated volumes that could be removed to support ex-situ treatment versus volumes that are inaccessible due to surface structures and safety. Information summarized in this evaluation will be used to update the CMS with this potential alternative. As all source material is not currently accessible, this option would require an ex-situ treatment option to be in combination with in-situ treatment approaches. A report will be prepared for EPA's review and comment prior to updating the CMS. The report will include a tabular summary of data generated in Tasks 1 through 3 and a schedule for revising the CMS, if a viable alternative is identified.
- **Optional Task 5 - Implementation and Evaluation of an ex-situ treatment pile Pilot Test.** This task will include the implementation of the pilot test if initial indications from the Bench Study suggest this is a highly effective option and EPA agrees that a Pilot Test would be appropriate prior to updating the CMS. The specific nature and design of the pilot test will be developed following approval to proceed with this approach rather than updating the CMS without pilot testing.

The bench study work described in this Workplan is anticipated to occur as soon as possible after collection of on-site samples and receipt of bench study chemicals. Each study will take varying times to complete. It is estimated that approximately 90 days will be required for the longest running study (aerobic biodegradation). Based on results of the studies, additional time would only be requested of EPA if essential to remedial alternative evaluations.

5. Rotosonic Drilling Methodology

GSI will collect data to further delineate the areal extent of the source zone by advancing temporary borings, logging soils, and collecting soil samples for analysis of TPH, PCP, and PAHs at depths to be determined in the field based on visual indications of highest likely COI concentration depth zone. The purpose is to define the extent of elevated COI impacts, which include NAPL and higher concentration zones under structures that serve as a source for downgradient groundwater impacts, as well as collecting soil samples for bench studies.

5.1 Evaluate Extents of Source Zone

Temporary borings will be installed under the treatment building and butt tank structure to at least five feet below the top of groundwater (~35 – 40 feet below ground surface [bgs]) or until refusal. The drilling subcontractor will advance angled soil borings using a rotosonic drill rig. Continuous soil samples will be obtained from the ground surface to the target depth. As the drill stem will not be positioned in a vertical direction, the TM will have to calculate vertical depth below ground surface based on the drilling angle using basis trigonometry. The borings will be advanced using 5- or 10-ft long outer casing sections, in a 6-inch borehole to obtain a 4-inch-diameter core barrel driven in 5-or 10-foot sampling runs

to the target depth. The retrieved sample will be vibrated out of the core barrel into a polyethylene bag for assessment and processing. A soil core would be retrieved from the entire length of each boring. The soil core would be carefully inspected by a geologist for soil types, lithology, obvious signs of contamination (using visual, olfactory, and vapor monitoring methods), presence/absence of water or NAPL, and presence of debris or non-soil matter (Baxter, 2002 - SADMP Section B2).

Representative grab samples would be obtained from the soil borings and retained for laboratory analysis. Soil cuttings not used for testing purposes will be containerized into United Nations (U.N) approved drums, properly labeled, and stored at the facility pending disposal determination (Baxter 2002 - SADMP Section B3). Soil samples for chemical and geochemical analysis would be collected from selected representative depths in each boring.

Up to ten samples will be analyzed from the five NAPL delineation boreholes; the depth intervals will be determined in the field by the geologist to provide representative coverage of different lithologies. At a minimum, soil samples will be collected and evaluated from the following four vertical horizon zones, if encountered:

- Upper zone of contamination (shallowest subsurface impacts, possibly related to LNAPL)
- Middle zone of contamination (core, possible smear zone)
- Deep zone of contamination (deepest subsurface impacts above and/or below the water table, possibly related to DNAPL)
- Depth of no apparent contamination (vertical extent of impact)

Representative soil and wood chip debris samples will be collected from both dense non-aqueous phase liquids (DNAPL) and light non-aqueous phase liquids (LNAPL) zones, if encountered in the boreholes. A summary of the planned soil analyses is presented in Table 1.

5.2 Material Collection for Bench Studies

Temporary borings will be installed in source areas with the highest historical concentrations of COIs. The drilling subcontractor will advance soil borings using a rotosonic drill rig vertically downward to target depths in an attempt to collect sufficient volumes and diversity of matrix materials. Continuous soil samples will be obtained from the ground surface to the target depths (as based on previous boring logs of adjacent borings). The borings will be advanced using a 5- or 10-ft-long casing sections, an in an 8-inch borehole will be drilled to obtain a 4-inch-diameter core barrel driven continuously to the target depth. Once the target depth has been achieved, the core barrel will be retrieved. The retrieved sample will be vibrated out of the core barrel into a polyethylene bag for assessment and processing. A soil core would be retrieved from the entire length of each boring. The soil core would be carefully inspected by a geologist for soil types, lithology, obvious signs of contamination (using visual, olfactory, and vapor monitoring methods), presence/absence of water or NAPL, and presence of debris or non-soil matter (Baxter, 2002 - SADMP Section B2).

Representative grab samples will be obtained from the soil borings and retained for bench testing. Samples will be collected from up to four boreholes; the depth intervals will be

determined in the field by the geologist to provide representative coverage of different lithologies and anticipated COI concentrations for bench testing. A summary of the material volumes necessary and target matrix is presented in Table 2.

6. Bench Studies

6.1 Objective

Determine the removal rates of select COIs from contaminated soils, taken from the source area, when subjected to 3 different treatment options:

- Aerobic biodegradation
- Soil washing with surfactants
- Chemical oxidation with addition of Fenton's reagent

Removal rates observed during this test will provide the necessary data for treatment pile design and the data obtained will be included in the CMS alternatives, if effective results are obtained.

Chemical oxidation with alkaline activated sodium persulfate was previously studied (along with other persulfate compounds and permanganate) and alkaline persulfate was found to be the most highly effective at removing PCP compared to other options evaluated. However, this oxidation agent was ineffective at removal of petroleum hydrocarbons and required a relatively high chemical loading to achieve PCP reduction success. In addition, the bench study was performed with the focus on a saturated in situ environment, which may not effectively replicate an ex situ soil pile design of vadose zone soil. While this data will not be excluded in the final SAIS evaluation, the lack of success on petroleum hydrocarbons would require persulfate oxidation to be followed-up with a secondary method to reduce other COIs in an ex-situ pile if this would drive more expensive disposal options.

The bench studies will evaluate treatment of four different matrices, if encountered during the delineation. A summary of the proposed bench study evaluations is provided in Table 3. The matrices to be evaluated in the bench studies include:

- Soil and wood chip matrix zone with DNAPL present
- Soil matrix zone only with DNAPL present
- Soil and wood chip matrix zone with mobile/LNAPL present
- Soil matrix zone only with mobile/LNAPL present

6.2 Baseline Sample Analysis

Each of the four sample matrices will be homogenized. Assuming 90 percent of the material is less than 2 millimeters (mm) in size, no further processing will be required. One aliquot will be analyzed for the following analytes by Apex:

- PAHs and PCP content (Method 8270 LL)
- NW TPH-Dx content
- Total Organic Carbon (TOC, Method 9060A)
- Biological Oxygen Demand (BOD, SM 5210B or equivalent)
- Phosphorous content (SM 365.1 or equivalent) and

- Nitrate content (SM 352.1 or equivalent).

An aliquot of each soil sample will be analyzed for pH and Total Oxidant Demand (TOD) for base-activated persulfate by RP. Information from TOD testing and estimates of the expected oxidant demand, based on the TOC 9060A results, will be used to estimate the Fenton's dosage levels for the treatability study. The BOD data will be used to estimate nutrient requirements for the aerobic biodegradation trials and the phosphorous and nitrate will guide nutrient formulation and application rate.

6.3 Control Study

The goal of the control study is to determine contaminant reduction simply by exposing the materials to atmosphere. The control will support all bench studies. The control study will simulate an aerated treatment biological degradation pile (biopile) where perforated piping or similar is placed throughout the treatment pile and atmospheric air is blown through the piping at low flow rates. The air would then diffuse through the pile and vent to atmosphere. This provides two major functions in a full scale environment. First, the oxygen in the air enhances aerobic biodegradation processes, which have been shown to be effective at reducing PCP concentrations through the recirculation pilot study. Second, the air movement, while at low flow rates, will assist with stripping more volatile components of the contaminants from the matrix, especially in warmer environments above grade during the summer and fall. Treatability testing services for each bench study will be subcontracted to RP and the testing will be conducted in coordination with GSI. The treatability testing will include:

- Measuring the initial BOD, phosphorous content, nitrate content, TOC, pH, and concentrations of COIs (PCP, PAHs, TPH) in the test soil.
- Developing an aerated reaction vessel with approximately 500 grams of each soil matrix.
- The reactors will include aerated test columns of each soil matrix with air movement occurring at low air flow rates. This would simulate air movement using solar fans at piping caps and low-flow electric blowers at inlet pipes as the mechanical blower method options in a full scale pile. The unamended control samples will consist of soil matrix materials only. The control studies will also support better understanding of low-flow air sparging approaches in subsurface vadose zone environments.
- Control samples typically will be allowed to react for no less than 90 days, unless complete reduction occurs before that time.
- Measuring the final biological activity, nutrient conditions, pH, and concentrations of COIs (PCP and PAHs) and target RCRA metals (if reduction of PCP and PAH below 20 times their respective RCRA toxicity characteristic leaching potential [TCLP] limits are achieved) in the test soil. Collected leachate concentrations, if generated, will be measured at the end of the study for pH, PCP and PAHs.
- All results from the bench study will be provided in a summary report.

A minimum soil quantity of approximately 500 grams per column is required for the effectiveness testing. No site groundwater is necessary for the testing.

6.3.1 Materials required

- Columns
- Low flow air pumps

- Carbon filters for venting air exhaust if study is performed in a closed laboratory with no vented hood
- Containers to capture leachate
- Thermometer

6.3.2 Prep Work

The buckets of soils from the Site will be sent to the lab to be broken up and uniformly composited. Equal volumes of soil (~16 kilograms per sample matrix) will be prepared for all bench studies.

6.3.3 Kickoff

Each of the four sample matrices will be homogenized as stated in Section 6.2. The homogenized material will be placed into a treatment vessel. To simulate the biopile soil in the microcosms, air flow will be applied to the top of the microcosm treatment vessel and extended through a tube to the bottom of the vessel. Prior to starting the study, the vessel will be turned to simulate pile mixing.

6.3.4 Regular Monitoring and Sampling

The unamended control treatment vessels will be analyzed after a minimum 90 days of reaction. After initial mixing, samples will not be re-mixed. Samples will be collected from various depths from the treatment vessels through ports and the removed sample will be homogenized. A representative aliquot will be used for analysis.

6.4 Aerobic Biodegradation Study

Similar to the Control Study, the goal of the biodegradation study is to simulate an aerated treatment biological degradation pile (biopile) where perforated piping or similar is placed throughout the treatment pile and atmospheric air is blown through the piping at low flow rates. The air would then diffuse through the pile and vent to atmosphere. As previously stated, this provides two major functions in a full scale environment, the oxygen in the air enhances aerobic biodegradation processes, and the air movement will assist with stripping more volatile components of the contaminants from the matrix Aerobic PCP degrading microorganisms have been shown to be present in the subsurface but petroleum degradation compounds and sufficient food source is lacking (AMEC, 2014). This will require addition of nutrient food source into the bench study and seeding with petroleum degrading microorganisms. A cursory literature review and vendor consultation identified Tersus Environmental products TersOx™Microbe and TersOx™Nutrients for use in the study. TersOx™Microbe includes aerobic and facultative microbial strains adapted for hydrocarbon degradation. Treatability testing services for each bench study will be subcontracted to RP and the testing will be conducted in coordination with GSI. The treatability testing will include:

- Measuring the initial BOD, phosphorous content, nitrate content, TOC, pH, and concentrations of COIs (PCP, PAHs, TPH) in the test soil.
- Developing an aerated reaction vessels with approximately 500 grams (g) of each soil matrix for amendment with TersOx™Microbe and TersOx™Nutrients. If nutrients are not limiting, consortium growth in the microcosms is directly proportional the starting concentration of microbes (i.e. the applied "dose"). The trials will apply microbes at a

rate of 0.2 grams per liter (g/L) of soil. Assuming 500 g is ~ 330 cubic centimeters (cm^3), the mass of TersOx™Microbe added to each microcosm will be ~0.067 g. TersOx™Nutrients is a formulation of nitrogen and phosphorous optimized for the petroleum degraders whose dose is estimated based on the BOD results found during baseline analyses. The nutrient application may vary among the samples. PCP degraders may benefit from additional phosphorous. This will be added to the microcosms in addition to the TersOx™Nutrients.

- Setting up the studies for varying matrices in different treatment vessels. The vessels will include aerated test columns of each soil matrix with air movement occurring at low air flow rates. This would simulate air movement using solar fans at piping caps and low-flow electric blowers and inlet pipes as the mechanical blower method options in a full scale pile.
- The treated samples will be allowed to react for no less than 90 days. Based on literature review and vendor discussions, this is the minimum estimated reaction time needed to achieve sufficient reduction of contaminates.
- Measuring the final biological activity, nutrient conditions, pH, and concentrations of COIs (PCP, PAHs, TPH) and target RCRA metals (if reduction of PCP and PAH below 20 times their respective RCRA TCLP limits are achieved) in the test soil. Collected leachate concentrations, if generated, will be measured at the end of the study for pH, PCP, TPH, and PAHs.
- All results from the bench study will be provided in a summary report.

A minimum soil quantity of approximately 500 grams per column is required for the effectiveness testing. No site groundwater is necessary for the testing.

6.4.1 Materials required

- Columns
- Low flow air pumps
- Carbon filters for venting air exhaust if study is performed in a closed laboratory with no vented hood
- Containers to capture leachate
- Thermometer
- TersOx™Microbe (~0.067 grams per sample matrix)
- TersOx™Nutrients (dose will be based on baseline BOD results)

6.4.2 Prep Work

The buckets of soils from the Site will be sent to the lab to be broken up and uniformly composited. Equal volumes of soil (~16 kilograms per sample matrix) will be prepared for all bench studies.

6.4.3 Kickoff

Each of the four sample matrices will be homogenized as stated in Section 6.2. The homogenized material will be placed into treatment vessels. To simulate the biopile soil in the microcosms, air flow will be applied to the top of the microcosm treatment vessels and extended through a tube to the bottom of the vessels. Prior to starting the study, the vessels will be turned to simulate pile mixing. During this vessel mixing, any nutrient and

microorganism spike agents that would be added to a particular column will be homogenized into the sample.

6.4.4 Regular Monitoring and Sampling

The amended treatment vessels will be analyzed after a minimum 90 days of reaction. After initial mixing, samples will not be re-mixed. Samples will be collected from various depths from the treatment vessels through ports and the removed sample will be homogenized. A representative aliquot will be used for analysis.

6.5 Chemical Oxidation with Fenton's Reagent Study

The goal of the chemical oxidation study is to re-evaluate chemical oxidation, instead using Fenton's reagents (without the use of site groundwater) to simulate an ex situ pile of vadose zone soil. Fenton's reagent appears to be the most effective chemical oxidant option at degrading both PCP and petroleum hydrocarbon (WSDOT, 1994). However, Fenton's can be challenging in an in-situ as the reactions can be hard to control and occur rapidly. Additionally, as this is an active, operating facility, in situ treatment would present vapor generation risks during reactions to the workers and chemical reaction concerns on buried infrastructure footers or piping. In an ex situ pile environment, reactions can be monitored and controlled more effectively and do not present risks to the infrastructure. It is not uncommon for ex situ chemical oxidation with Fenton's reagent to be followed up by biological degradation as a polishing step. As such, at the completion of the chemical oxidation study, the material may be transferred to an aerated column if complete degradation does not occur with chemical oxidation (>90% reduction of PCP and PAHs).

Treatability testing services for each bench study will be subcontracted to RP and the testing will be conducted in coordination with GSI. The treatability testing will include:

- Measuring the initial BOD, phosphorous content, nitrate content, TOC, pH, and concentrations of COIs (PCP, PAHs, TPH) in the test soil.
- Determining if TOD is too high to make Fenton's a viable option for testing. Samples where TOD does not support Fenton's testing will be excluded.
- For potentially viable matrix materials, developing a reaction vessel with 1 kg of each soil matrix where Fenton's reagents will be added to the matrix. Based on the baseline estimated oxidant demand and the TOC content, a low and high dose of Fenton's chemistry will be selected. Due to the anticipated high oxidant demand, the trials may require up to 1,500 g (~1.4 L) of a 30 weight by percent (wt.%) hydrogen peroxide (H_2O_2) solution. Ferrous sulfate (Fe) will be used as catalyst and mixed into the soil at a ratio of 1-part Fe per 10 parts H_2O_2. Then the peroxide will be added slowly and stirred into the soil. The persulfate TODs will be used to estimate the low end of the Fenton's reagent doses.
- Recording effervescence and heat generation during reagent addition and mixing.
- Adjusting the pH to 4 to 5 during the testing by adding sulfuric acid.
- As Fenton's reagent is a rapid reduction process, control and treated samples typically would be allowed to react and settle for approximately 48 hours.
- Removing and containerizing the free liquid over the soil.

- Measuring the final pH, TOC and concentrations of COIs (PCP, PAHs, and TPH) and target RCRA metals (if reduction of PCP and PAH below 20 times their respective RCRA TCLP limits are achieved) in the test soil.
- All results from the bench study will be provided in a summary report.

If the post-treatment PCP and PAH concentrations have been successfully reduced by at least 50%, but have not achieved a >90% reduction, the following additional studies may be performed:

- Repeat the Fenton's applications for each of the four matrix samples and/or
- Repeat the best performing Fenton's application for each of the four matrix samples to be followed by an aerobic polishing step as described below.

A minimum soil quantity of approximately 1kg per sample matrix is required for the effectiveness testing. No site groundwater is necessary for the testing.

6.5.1 Materials required

- Reaction vessels
- Carbon filters for venting air exhaust if study is performed in a closed laboratory with no vented hood
- Thermometer
- Hydrogen peroxide (up to 1,500 grams of a 30% solution)
- Ferrous sulfate (1-part Fe per 10 parts H_2O_2)
- Sulfuric Acid

6.5.2 Prep Work

The buckets of soils from the Site will be sent to the lab to be broken up and uniformly composited. Equal volumes of soil (~16 kilograms per sample matrix) will be prepared for all bench studies.

6.5.3 Kickoff

Each of the four sample matrices will be homogenized as stated in Section 6.2. Equal volumes of homogenized soil will now have the Fenton's reagents added to the material and placed into the treatment vessels. At this point, the study will begin. The treatment containers will be vented to the environment to prevent pressure building.

6.5.4 Regular Monitoring and Sampling

The treatment vessels will be analyzed after a minimum of 48 hours of reaction. Samples will be collected from various depths from the treatment vessels through ports and the collected sample will be homogenized. A representative aliquot will be used for analysis.

6.6 Surfactant Soil Washing Study

The goal of surfactant washing is to strip contaminants from the soil matrix to a sufficient degree to allow for re-use onsite. Surfactants will be added to a fixed concentration in water and then washed over the soil matrix to simulate pile washing operations at a fixed dosage rate. The leachate would then be collected for analysis. This process can be performed once at a high rate or continually at a slow rate to strip contaminants from the matrix. The surfactants are non-toxic and it is assumed the soil washing leachate could be transferred to

a settling tank to extract fine soil and then to an oil water separator brought in to support the operation or to the facility oil-water separator and into the plant treatment train. Water could be recycled from a project specific oil-water separator to the washing input point. Any oil not sent to the facility treatment train would require testing and disposal but the volumes and costs are anticipated to be significantly less than disposal of the entire soil pile. Treatability testing services for each bench study will be subcontracted to RP and the testing will be conducted in coordination with GSI. Two surfactants (Tween 80 and Triton X-100) have been selected by GSI for this treatability study evaluation. The study will evaluate the two products at a single vendor-recommended dose for each. Other surfactants may be substituted, if availability is a challenge. Treatability testing services will include:

- Measuring the initial BOD, phosphorous content, nitrate content, TOC, pH, and concentrations of COIs (PCP, PAHs, TPH) in the test soil.
- Placing a column of two kilograms of each of the four soil matrices into a treatment vessel for surfactant addition.
- Mixing the prepared surfactant and water blend (2 Liters) with the soil yielding an applied soil dose of 10 g/kg of Tween 80 and 50 g/kg of Triton X-100.
- Stirring the soil slurry by hand twice per day for three days to maximize contact between the surfactants and the soil.
- Draining the soil through a fine-mesh sieve, after the vendor-specified reaction time of 72-hours. The drained surfactant will be collected for analysis.
- Flushing the soil with approximately 2 Liters (2L) of tap water twice, with water collected after each flushing. The 2L surfactant and tap water flushes are designed to meet the testing laboratory's sample volume requirements and would simulate additional washing to ensure surfactants are completely flushed through the pile.
- Collecting aqueous samples for each of the four matrices from the two reagent trials after flushing is complete. The aqueous samples will be analyzed for concentrations of the COIs (PCP, PAHs, and TPH).
- Measuring the final pH and concentrations of COIs (PCP, PAHs, TPH) and target RCRA metals (if reduction of PCP and PAH below 20 times their respective RCRA TCLP limits are achieved) in the test soil.
- All results from the bench study will be provided in a summary report.

If the post-treatment PCP and PAH concentrations have been successfully reduced by at least 50%, but have not achieved a <90% reduction, the following additional studies may be performed:

- Repeat the surfactant applications for each surfactant and sample and/or
- Repeat the best performing surfactant application for each of the four matrix samples to be followed by an aerobic polishing step as described below.

A minimum soil quantity of approximately 2 kg per four sample matrices is required for the effectiveness testing. No site groundwater is necessary for the testing.

6.6.1 Materials required

- Column
- Sprayer
- Surfactant and water mixing container

- Collection container for wash fluid
- Thermometer
- Dow Triton X-100 (50 g/L) and Sigma Aldrich Tween 80 (10 g/L) surfactants (or similar)

6.6.2 Prep Work

The buckets of soils from the Site will be sent to the lab to be broken up and uniformly composited. Equal volumes of soil (~16 kilograms per sample matrix) will be prepared for all bench studies.

6.6.3 Kickoff

Each of the four sample matrices will be homogenized as stated in Section 6.2. Equal volumes of homogenized soil will be placed into the column and soil washing will commence. At this point, the study will begin.

6.6.4 Regular Monitoring and Sampling

The treatment vessels will be analyzed after a minimum of 72 hours of reaction. After initial mixing, samples will not be re-mixed. Samples will be collected from various depths from the treatment vessel through ports and the collected sample will be homogenized. A representative aliquot will be used for analysis.

6.7 Aerobic Biodegradation Polishing

If an aerobic biodegradation polishing step is selected following one or both of Fenton's reagent or surfactant trials, one or both of the trials will be repeated as described above using the aerobic biodegradation study and control process for any of the matrices studied.

Up to four 500-g microcosms will be prepared for one or both of Fenton's reagent or surfactant trials; two unamended controls and two inoculated and nutrient-amended microcosms as described above for each of 4 matrix samples, totaling 8 Fenton's polishing trials and 8 surfactant polishing trials. The aerobic degradation trials will then proceed as described above.

7. Sample Handling, Documentation, and Transport

Samples will be traceable from the time of collection through laboratory and data analysis. To ensure samples collected are traceable, the procedures described in this section will be followed.

7.1 Field Logbook

The field activities and observations will be noted in a field logbook and sample description form. The following site activity records will be documented in the field logbook and/or sample description form:

- Sample information, including station ID, date/time of collection, type of sample, and description (applicable only when field form is not used)
- General physical characteristics of the samples will be described and recorded on a sample description form, following the American Society of Testing Material (ASTM) D2488 visual soil classification procedure (ASTM, 2017)

- Any changes that occur at the Site (e.g., personnel, responsibilities, deviations from the Workplan) and the reasons for such changes

Entries will be written clearly with enough detail so that participants can reconstruct events later, if necessary. Field logbooks will be bound, with consecutively numbered pages—removal of any pages is prohibited. Unbiased, accurate language will be used and entries will be made while activities are in progress or as soon afterward as possible. Field logbook and sample description form corrections will be made by drawing a single line through the original entry allowing the original entry to be legible. Corrections will be initialed and the corrected entry will be written alongside the original. When field activities are complete, the field logbook and sample description forms will be retained in the project file at GSI's Portland, Oregon, office.

7.2 Sample Containers, Preservation, and Holding Times

Laboratory samples will be placed directly in the appropriate sample containers (Table 2) and bench study samples will be placed in 5 gallon buckets with sealed lids for transport back to the laboratory. Sample containers, as well as coolers and packing material, will be supplied by the laboratory. Commercially available pre-cleaned jars will be used and the laboratory will maintain a record of certification from the suppliers. Sample containers will be labeled clearly at the time of sampling. Labels will include the project name, sample ID, analysis to be performed, date, and time.

7.3 Sample Identification and Labeling

During sample collection, a unique code will be assigned to each sample as part of the data record. Station IDs are listed in Table 1. The ID code will indicate the sample type, sampling location, and level of duplication. The first component of the sample ID will contain an abbreviation for the sample type followed by the station ID, with leading zeros used for stations for ease of data management and correct sorting. The month and year will be added to the sample ID. Additional codes may be adopted, if necessary, to reflect sampling needs.

The following are examples of sample IDs for discrete grab samples:

- GB-003_0522-8-10: Grab soil sample collected in May 2022 from Borehole 3 from 8 to 10 feet bgs.
- BS-SL01_0522-20-25: Bench Study soil sample collected in May 2022 from 20 to 25 feet bgs

7.4 COC Procedures

Samples are in custody if they are in the custodian's view, stored in a secure place with restricted access, or placed in a container secured with custody seals. A COC record will be signed by each person who has custody of the samples and will accompany the samples at all times. Copies of the COC form will be included in contract laboratory reports and attached to the final data evaluation report. When transferring sample custody, the COC form will be signed, dated, and the time of transfer will be noted.

The original COC form will be transported with the samples to the selected contract laboratories. Upon receipt, the laboratory sample custodian will inventory the samples by

comparing sample labels to those on the COC form. The custodian will enter the sample number into a laboratory tracking system by project code and sample designation. The custodian will assign a unique laboratory number to each sample and will be responsible for distributing the samples to the appropriate analyst or for storing samples in an appropriate secure area.

The laboratories will maintain COC procedures internally and when samples are shipped to subcontracted laboratories or during shipment between laboratories.

For bench studies, unique IDs will be assigned to each bench test and support information will note the source matrix and bucket ID the material care from.

7.5 Sample Packaging and Shipping

The laboratory will supply sample coolers and packing materials for each sampling event. Upon completion of the final sample inventory, all samples, except 5 gallon buckets, will be packed in a cooler. Glass jars will be packed to prevent breakage and separated in the shipping container by bubble wrap or other shock-absorbent material. Ice in sealed plastic bags will be placed in the cooler to maintain a temperature of approximately 4 degrees Celsius (°C).

When the cooler is full, the COC form will be placed in a re-sealable bag and taped onto the inside lid of the cooler. A temperature blank will be added to each cooler. Coolers will be transported to the laboratory by GSI field personnel.

The 5-gallon buckets will be sealed, taped at the lid edges, and placed in appropriately sized cardboard boxes lined with packing materials to protect the bucket and sample integrity during transport. The box lids will be securely taped and the boxes will be transported at ambient temperatures. Laboratory sampling to represent initial COI concentrations will not be collected until the bucket is reopened in the laboratory during bench study setup. This will ensure initial concentrations are representative of post-transit conditions as chilling the samples during transport is infeasible and unnecessary for data quality objectives. The buckets will be taped around the lid edges after sealing and kept away from direct sunlight to minimize the potential for volatilization and photo degradation effects to ensure concentrations are as representative as possible of initial ex-situ conditions. The bucket materials will be re-homogenized in a larger container after arrival if NAPL separation from the matrix materials occurs between containerizing and opening of buckets at the laboratory.

8. IDW Management

Investigation-derived waste (IDW) will be generated during sampling and as a result of bench studies. Soil cuttings not used for testing purposes will be containerized into United Nations (U.N.) approved drums, properly labeled, and stored at the facility pending disposal determination (Baxter 2002 - SADMP Section B3). All disposable materials used in sample collection and processing, such as paper towels and gloves, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be placed in a normal refuse container for disposal at a solid waste landfill. At the completion of bench studies, additional materials will be disposed of by Apex laboratory in accordance

with their Standard Operating Procedures (SOPs) or the material will be returned to the facility to add to the IDW drums.

9. Equipment Decontamination Procedures

Equipment that comes in direct contact with samples, such as stainless steel samplers, homogenization bowls and spoons, or containers will be decontaminated at the beginning of the sampling event, between sampling locations, and at the end of the sampling event. In addition, bench study design vessels and supporting direct contract equipment will be decontaminated prior to initiation of tests. Decontamination will occur using the following procedure:

- Wash with a brush and Alconox or other phosphate-free detergent.
- Rinse with tap water.
- Rinse with deionized water.
- Collect equipment blank sample as described below.
- When dry, cover decontaminated equipment with aluminum foil for temporary storage and/or transport, if applicable.

To minimize sample contamination, gloves will be replaced after handling each sample, or more frequently, as appropriate.

9.1 Equipment Blanks

Equipment blanks will be collected once during the sampling event from the soil sampling devices and stainless steel homogenization devices after decontamination to evaluate the decontamination process. The equipment blank sample will be collected by passing laboratory-supplied deionized water over all sampling equipment used during the day. The sample will be collected directly into the sample containers.

10. Laboratory Analysis

This section summarizes the chemical analyses to be performed. The laboratory quality control (QC) and data validation protocols that will be followed to ensure that (1) data quality and representation are in accordance with method requirements and (2) data usability is appropriately assessed.

10.1 Chemical Analysis

All primary soil samples will be analyzed for TPH, PAHs, and PCP. Table 1 summaries the overall sample collection and analysis plan. Table 2 presents details about the sample containers, preservation, holding times, and analytical methodologies. Method reporting and laboratory detection and control limits by analyte are included in Attachment B.

11. Quality Control and Quality Assurance

11.1 Laboratory QA/QC Procedures

Laboratory QA/QC will be maintained through the use of standard U.S. Environmental Protection Agency (EPA) methods and other accepted methods and standard analytical procedures for the target analytes. Analytical methods and QC measurements and criteria

are based on EPA guidance. The TM will coordinate with the laboratories during the chemical analyses and throughout delivery and validation of the laboratory results.

As noted for the field QC protocols, the field samples will be packaged, managed, and transferred to the laboratories according to the appropriate procedures and with sufficient time and coordination to meet analytical holding times, as generally summarized in Table 2. Following the successful delivery of samples, the laboratory will follow the method-specific and other analytical and laboratory QC procedures and protocols that will be requested by the laboratory before selection.

11.2 Instrument/Equipment Testing, Inspection, and Maintenance

Analytical instrumentation will be tested, inspected, and maintained by each laboratory according to requirements specified in the laboratory Quality Assurance Manuals (QAMs), method-specific SOPs, and instrument manufacturer instructions. Laboratory facilities are designed to meet specific operating conditions and maintained in a condition to ensure that acceptable operating conditions are met. Instruments will only be utilized for sample analysis if they demonstrate the capability of achieving the required accuracy and compliance with relevant instrument specifications. Only authorized personnel will operate analytical instrumentation and testing equipment. Instrument maintenance and repair will be documented in maintenance logs or record books.

11.3 Instrument/Equipment Calibration and Frequency

Laboratory instruments will be properly calibrated, and the calibrations will be verified with the appropriate check standards and calibration blanks for each parameter before beginning analysis, as specified in method- and/or laboratory-specific SOPs. Instrument calibration procedures and schedule will adhere to analytical protocol requirement and descriptions included in laboratory QAMs and method-specific SOPs. Records of calibration will be maintained by the laboratory to document the performance and maintenance of each instrument.

Calibration standards will be obtained that are traceable to recognized national or international standards, whenever available. Certificate of analysis records for laboratory standards will be retained by the Laboratory QA Manager. Reference standards will be stored according to the manufacturer's recommendations, laboratory SOPs, and/or test method specifications.

12. Data Management

Data management protocols for both field data and electronic data will be implemented to provide consistent, accurate, and defensible documentation of data quality.

12.1 Field Documentation

Field activities and observations will be documented in field logbooks during implementation of the sampling activities. Grab sample descriptions will be completed for all samples. COC forms, which document sample possession and handling from the time of collection through relinquishment to the primary contract laboratory, will be maintained as part of the field records.

The field records will be kept in the project file as a permanent record of the sampling or field measurement activities. All field records will be copied, scanned, and/or entered into an electronic spreadsheet to create an electronic record for the project file. QA reviews by the PM will check for electronic/hard copy inconsistencies and identify anomalous values or erroneous entries.

12.2 Electronic Data Management

The electronic field data will be incorporated into the project database by the database manager. Management of electronic data files of this Workplan and the other supplemental investigations will be managed in accordance with those guidelines.

13. Reporting and Schedule

The data from this Workplan will be included in the final data evaluation report. This data evaluation report will document field activities, bench study activities, and analytical results from each task, and describe any deviations from the SIAS WP.

The data evaluation report will be submitted as soon as possible after final laboratory data is provided and all bench studies are completed. The estimated time frames for completion of the work plan, source area investigation, bench study activities, evaluation of results, and report preparation and submittal are provided in Attachment C.

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Tables

Table 1. Analytical Schedule for Baseline Sampling

J.H. Baxter Former Arlington Facility, Arlington, Washington - SAIS WP

Station ID	Coordinates (x,y in NAD 1983 State Plane Washington North)	Sample ID	Number of Containers	Container Volume	Analytical Methods									
					pH (by RP)	TOD (by RP)	9045D (pH)	9060A (TOC)	5210B (BOD)	365.1 (Phosphorus Content)	352.1 (Nitrate Content)	8270E LL (PAHs/PCP)	NW TPH-Dx	6020B (Target RCRA Metals)
SB-86	1320724.71719 , 427397.130675	SB-086_0522	TBD	TBD based on field observations			X					X	X	
SB-87	1320787.92224 , 427310.284035	SB-087_0522	TBD	TBD based on field observations			X					X	X	
SB-88	1320900.24457 , 427266.341692	SB-088_0522	TBD	TBD based on field observations			X					X	X	
SB-89	1320927.21505 , 427420.116938	SB-089_0522	TBD	TBD based on field observations			X					X	X	
SB-90	1320847.39084, 427389.094539	SB-090_0522	TBD	TBD based on field observations			X					X	X	
SB-H	1320852.61122 , 427263.079134	BS-SB-E_0522	1	5 gallon bucket	X	X		X	X	X	X	X	X	TBD
SB-G	1320832.81837 , 427300.489802	BS-SB-F_0522	1	5 gallon bucket	X	X		X	X	X	X	X	X	TBD
SB-F	1320805.84789 , 427445.347389	BS-SB-G_0522	1	5 gallon bucket	X	X		X	X	X	X	X	X	TBD
SB-E	1320756.257 , 427440.344799	BS-SB-H_0522	1	5 gallon bucket	X	X		X	X	X	X	X	X	TBD

Notes

ID: Identifier

PCP: Pentachlorophenol

TOC: Total Organic Carbon

TBD: To be determined

RCRA: Resource Conservation and Recovery Act

NW TPH-Dx: Northwest method Total Petroleum Hydrocarbons - Diesel

PAH: Polycyclic aromatic hydrocarbons

BOD: Biological Oxygen Demand

RP: ReSolution Partners, LLC

TOD: Total Oxidant Demand

Table 2. Laboratory Methods, Sample Containers and Holding Times for Samples

J.H. Baxter Former Arlington Facility, Arlington, Washington - SAIS WP

Analyte Group	Analyte/Analyte Group	Laboratory Method	Sample Bottle	Preservative
Soil Samples (Laboratory)				
Total Metals	Target RCRA metals (Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, & Zinc)	EPA 6020B	1- 16 oz jar	0 - 6 °C
TOC	--	EPA 9060A		
pH	--	EPA 9045D		
PAHs/PCP	--	EPA 8270E LL		
TPH - Diesel/Oil	--	NW TPH - Dx		
Soil Samples (Resolution Partners)				
Phosphorus	--	EPA 365.1	5 gallon bucket	None
Nitrate	--	EPA 352.1		
pH	--	SOP		
TOD	--	SOP		
Groundwater Samples				
PAHs/PCP	--	EPA 8270E LL	2 x 1L amber unpreserved, and 2 x 1L amber HCl	0 - 6 °C
TPH - Diesel/Oil	--	NW TPH - Dx		

Notes

°C: degrees Celsius

oz: ounce

L: Liter

SOP: ReSolution Partners Standard Operating Procedure

TOD: Total Oxidant Demand

HCl: Hydrochloric acid

TOC: Total Organic Carbon

PAHs/PCP: Polycyclic aromatic Hydrocarbons/Pentachlorophenol

TPH: Total Petroleum Hydrocarbons

TCLP: Toxicity Characteristic Leaching Procedure

EPA: U.S. Environmental Protection Agency

NW TPH - Dx: Northwest method Total Petroleum Hydrocarbons - Diesel

Table 3. Summary of Proposed Bench Study Trials

J.H. Baxter Former Arlington Facility, Arlington, Washington - SAIS WP

Bench Study	Matrix				Reagent Volume per Matrix	Reaction Period	Post-Treatment Sample Media Per Matrix	Analytical Methods							
	DNAPL w/ Wood Chip Debris	DNAPL Soil	LNAPL w/ Wood Chip Debris	LNAPL Soil				pH (by RP)	9060A (TOC)	5210B (BOD)	365.1 (Phosphorus Content)	352.1 (Nitrate Content)	8270E LL (PAHs/PCP)	NW TPH-Dx	*6020B (Target RCRA Metals)
Control Study	500-g	500-g	500-g	500-g	None	~ 90 days	Soil	X		X	X	X	X	X	X
							Leachate (if collected)						X	X	
Aerobic Biodegradation	500-g	500-g	500-g	500-g	TersOx™Microbe: ~0.067 g	~ 90 days	Soil	X		X	X	X	X	X	X
					TersOx™Nutrient: dose based on baseline BOD results		Leachate (if collected)						X	X	
Chemical Oxidation (Fenton's)	1 -kg	1-kg	1-kg	1-kg	Ferrous Sulfate: 1-part Fe per 10 parts H_2O_2	48 hours	Soil	X	X				X	X	X
					Hydrogen Peroxide (30% Solution) : up to 1,500-g										
Surfactant Tween 80	2-kg	2-kg	2-kg	2-kg	10 g/L	72 hours	Soil	X					X	X	X
							Aqueous - Post-flushing	X					X	X	
Surfactant Triton X-100	2-kg	2-kg	2-kg	2-kg	10 g/L	72 hours	Soil	X					X	X	X
							Aqueous - Post-flushing	X					X	X	
Aerobic Biodegradation Polishing - Following Fenton's Reagent (if needed)	500-g	500-g	500-g	500-g	TersOx™Microbe: ~0.067 g TersOxTMNutrient: dose based on baseline BOD results	~ 90 days	Soil	X		X	X	X	X	X	X
							Leachate (if collected)						X	X	
Aerobic Biodegradation Polishing - Following Surfactant Reagent (if needed)	500-g	500-g	500-g	500-g	TersOx™Microbe: ~0.067 g TersOxTMNutrient: dose based on baseline BOD results	~ 90 days	Soil	X		X	X	X	X	X	X
							Leachate (if collected)						X	X	

Notes

DNAPL: Dense Non-aqueous Phase Liquid

LNAPL: Light Non-aqueous Phase Liquid

PCP: Pentachlorophenol

PAH: Polycyclic aromatic hydrocarbons

RCRA: Resource Conservation and Recovery Act

BOD: Biological Oxygen Demand

TOC: Total Organic Carbon

NW TPH-Dx: Northwest method Total Petroleum Hydrocarbons - Diesel

* : Target RCRA metals will be analyzed if >90% reduction of PCP and PAHs occurs in the test soil.

RP: ReSolution Partners, LLC

kg: kilogram

L: Liter

g: gram

Figures

LEGEND

- Cities
- Railroads
- Major Roads
- Watercourses

MAP NOTES:
Date: July 25, 2016
Data Sources: Air photo taken on September 28, 2015 by the USDA

FIGURE 1

Site Vicinity Map

Former J.H. Baxter Wood Treating Facility
Arlington, Washington

N

0 0.5 1
Miles

GSI Water Solutions, Inc.

Document Path: P:\Portland\302 - Baxter\GIS\Arlington_RCRA\Project_mxds\2016_1H_SA_Report\Figure1_Site_Vicinity_Map.mxd

FIGURE 4-2

Residual NAPL Thickness

Former J.H. Baxter
Wood Treating Facility
Arlington, Washington

LEGEND

- Angled Boring (arrow indicates approximate direction)
- Vertical Boring for Bench Study
- Monitoring Well, NAPL Observed
- Monitoring Well, NAPL not Observed
- Soil Boring, NAPL Observed
- Soil Boring, NAPL not Observed
- Boring Advanced Below Depth of Visual or Olfactory Signs of Contamination
- Estimated NAPL Extent

All Other Features

- Infiltration Gallery Piping
- Infiltration Trench
- Historical Process Units

NOTES
NAPL: Nonaqueous Phase Liquid
Soil Boring Location values are residual NAPL thickness in feet.

N

0 21 42 63
Feet

Date: August 17, 2021
Data Sources: AMEC, ESRI, Air photo taken on May 2, 2015 by Google Earth

GSI Water Solutions, Inc.

Document Path: Y:\0302_Baxter\Source_Figures\Arlington_RCRA\2021_Agency_Discussions\Figure4-2_Residual_NAPL_Biotreatment_Alternative_.mxd

Attachment A
Health and Safety Plan

DRAFT

Attachment A of Source Area Investigation and Study

GSI Site-Specific Health and Safety Plan

Former J.H. Baxter & Co. Wood Treating Facility, Arlington, Washington

Prepared for the U.S. Environmental Protection Agency

August 2021

Prepared by:

GSI Water Solutions, Inc.

55 SW Yamhill St., Suite 300, Portland, OR, 97204

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Site-Specific Health and Safety Plan

Prepared for:

U.S. Environmental Protection Agency

Alison Clements
HASP Preparer

Prepared by:

GSI Water Solutions, Inc.
55 SW Yamhill Street, Suite 300
Portland, Oregon 97204

Josh Bale, Professional Engineer (PE)
HASP Reviewer

Josh Bale
Supervising Project Manager

Contents

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Abbreviations and Acronyms

°F	degrees Fahrenheit
AED	automated external defibrillator
AHA	activity hazard analysis
CFR	Code of Federal Regulations
COC	contaminant of concern
CPR	cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
DEQ	Oregon Department of Environmental Quality
EMS	emergency medical services
EPA	U.S. Environmental Protection Agency
EZ	Exclusion Zone
GFCI	ground fault circuit interrupter
GSI	GSI Water Solutions, Inc.
HAZWOPER	Hazardous Waste Operations and Emergency Response
HASP	Health and Safety Plan
LOTO	lockout/tag-out
mph	miles per hour
NRC	National Response Center
OSHA	U.S. Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PE	Professional Engineer
PFD	personal flotation device
PM	Project Manager
PPE	personal protective equipment
Site	Former J.H. Baxter & Co. Wood Treating Facility Site
SAIF	State Accident Insurance Fund Corporation
SAP	field sampling plan
SDS	safety data sheets
SSO	Site Safety Officer
STSC	Safety Trained Supervisor - Construction
SZ	Support Zone

SECTION 1: **Emergency Action Plan**

1.1 Emergency Services and Contacts

In case of emergencies, call 911.

Always use an ambulance to go to the closest hospital (Table 1) for life-threatening injuries.

Table 1. Emergency Contacts

Emergency Service or Contact	Name	Phone Number
Local Police	Arlington Police Department	911 (emergency) 360.403.3400 (non-emergency)
Local Ambulance	Trans-West Ambulance Service	911 (emergency)
Local Fire Department	Arlington Fire Department	911 (emergency) 360.403.3600 (non-emergency)
Local Hospital	Cascade Valley Hospital 330 S Stillaguamish Ave, Arlington, WA 98223	911 (emergency) 360.435.2133 (non-emergency)
Local Urgent Care	Skagit Regional Clinics - Urgent Care Smokey Point	360.657.8700
GSI Safety Officer	Josh Bale (GSI Water Solutions, Inc.)	Office: 971.200.8502 Cell: 530.276.4188
GSI Incident Intervention (WorkCare)	WorkCare	888.449.7787
Poison Control Center	—	1.800.222.1222
Washington Emergency Management Division (to report a hazardous spill to the state agency)	—	911 emergency 1.800.OILS.911
National Response Center (NRC) (to report a hazardous spill)	—	1.800.424.8802
State Reporting Agency (Washington Department of Labor and Industries Division of Occupational Safety and Health)	—	1.800.547.8367 (Washington)
Consultant Project Manager	Josh Bale (GSI Water Solutions, Inc.)	Office: 971.200.8502 Cell: 530.276.4188
Site Safety Officer	Joe Sherrod (GSI Water Solutions, Inc.)	Office: 971.200.8547 Cell: 253.486.9014

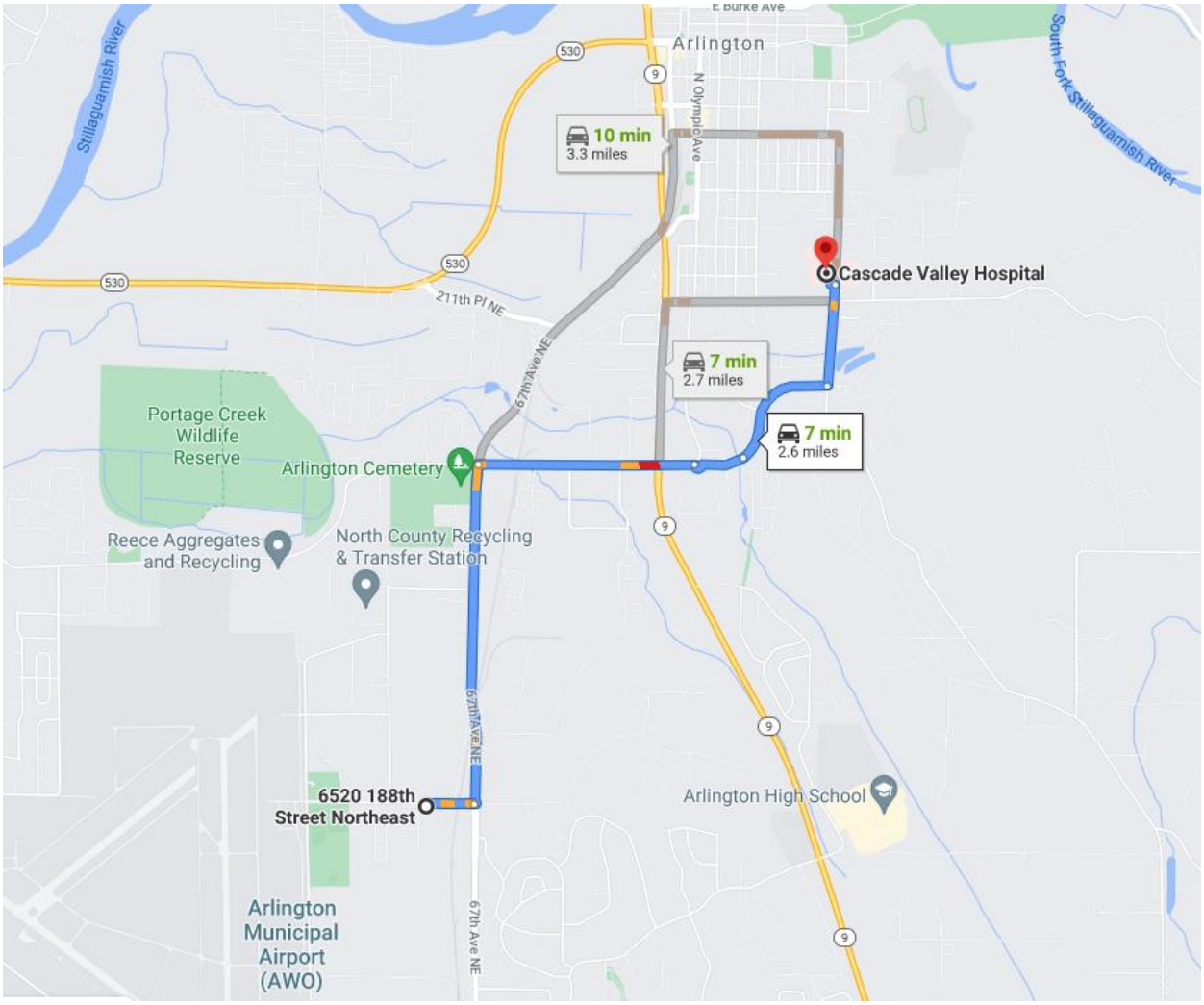
Client Group Name Project Coordinator	Georgia Baxter	Cell: 650.653.0402

1.2 Hospital Location and Directions Map

The muster point for upland work will be the entrance along 188th St NE. Emergency medical services should be directed to meet personnel at the Site entrance at 6520 188th Street NE in Arlington, Washington.

Driving directions to the nearest emergency medical facility (2.6 miles) from the Former J.H. Baxter & Co. Wood Treating Facility to Cascade Valley Hospital (330 S Stillaguamish Ave, Arlington, Washington 98223).

1. Head east on 188th St NE toward 66th Ave NE (0.1 mi).
2. Turn left onto 67th Ave NE (1.0 mi).
3. Turn right onto 204th St NE/Kent Prairie Rd (0.6 mi).
4. At the traffic circle, continue straight to stay on 204th St NE/Kent Prairie Rd (0.2 mi).
5. Continue onto 207th St NE (0.4 mi).
6. Turn left onto S Stillaguamish Ave (0.3 mi).
7. Turn left (108 ft).
8. Arrive at Cascade Valley Hospital.



The trip from the Former J.H. Baxter & Co. Wood Treating Facility to Cascade Valley Hospital can take 7 to 10 minutes or more, depending on time of day and traffic conditions. Personnel should check road conditions on a map application immediately prior to transport to hospital.

To facilitate emergency medical services (EMS) in locating the Former J.H. Baxter & Co. Wood Treating Facility, one person when available, should meet EMS at the Site entrance on 188th St NE.

1.3 Emergency Procedures

In the event of emergency, personnel will be instructed to leave the area immediately and the Site Safety Officer (SSO) will contact the appropriate emergency response providers listed in Table 1 in Section 1.1 of this Health and Safety Plan (HASP). Directions to the nearest medical facility from the evacuation dock location for overwater work and the muster point for upland work are provided in Section 1.2 of this HASP. An Incident Report Form will be completed when there is an accident (see Section 13 and Attachment 1).

Field personnel will be trained in first aid procedures (including cardiopulmonary resuscitation [CPR]) and will have access to a first aid kit. Consistent with U.S. Occupational Safety and Health Administration (OSHA) recommendations, an automated external defibrillator (AED) will be available onsite. All field staff will be trained to administer the AED. The AED and first aid kit will be located to sampling activities in an unlocked location. The AED will include a procedures diagram for use. The SSO will check the AED periodically for sufficient battery charge.

In the event of an occupational accident or incident, please indicate to the medical facility that this is a Workers' Compensation case, that your employer is GSI Water Solutions, Inc. (GSI), and that the insurance administrator for Workers' Compensation claims is State Accident Insurance Fund (SAIF) Corporation. Subcontractors should follow their company policies related to injury reporting. All subcontractors must follow company protocols for occupational injury and accident reporting.

1.4 Emergency Supplies and Equipment List

Table 2 lists needed equipment, locations, and notes for use.

Table 2. Safety and Other Equipment Locations

Equipment	Location and Notes
First aid kit	Required for all work.
Class ABC fire extinguisher	Required for all work. Fire extinguisher is the responsibility of marine contractor for overwater work and drilling contractor for shoreline work.
Whistle/air horn	Required for overwater work. Recommended for upland work.
Spill equipment (sorbent pads, booms, etc.)	Responsibility of marine contractor for overwater work and drilling contractor for shoreline work.
Eye wash station	Required for all work.
Flashlights, head lamps	Required when working between dusk and dawn. Lighting support also required when visibility is less than 5 foot-candles within 3 feet of worker.
Automated external defibrillator (AED)	Required for all work.

SECTION 2: **Organizational Structure**

This site-specific HASP has been developed for the Former J.H. Baxter & Co. Wood Treating Facility on behalf of the J.H. Baxter & Co. for work within the source area investigation boundaries in accordance with OSHA 29 Code of Federal Regulations (CFR) 1910 and 1926, and the GSI Health and Safety Policy (GSI, 2020). This HASP covers potential field hazards associated with the tasks necessary to complete the Scope of Work for all Site support activities, including sampling, surveying, technical field support to the client, and field reconnaissance.

Site Name and Address	Former J.H. Baxter & Co. Wood Treating Facility, 6520 188th Street NE Arlington, Washington		
Project Name	Former J.H. Baxter & Co. Wood Treating Facility	**Project Number**	0302
Date	August 2021	**Revision Number**	0

2.1 Project Team Organization and Authorities

Table 3 provides project roles and responsibilities for field staff members and subcontractors relative to this HASP.

Table 3. Project Roles and Responsibilities

Name	Role	Responsibility
Josh Bale (GSI Water Solutions, Inc.)	Project Manager (PM)	The PM has overall responsibility for the delivery of the project and management of all members of the team, including external advisors and subcontractors. The PM is the point of contact for the client and regulatory agencies with respect to implementation of this HASP. The PM has the responsibility and authority to direct all work operations, oversee and coordinate safety and health functions with the Site Safety Officer and ensures the implementation of HASP requirements and procedures in the field.
Joe Sherrod or as designated by PM	Site Safety Officer (SSO)	The SSO has full responsibility and authority to develop and implement this HASP and to verify compliance. The SSO is at the Site or readily accessible to the Site during all work operations and has the authority to halt work if unsafe conditions are observed or suspected.
Subcontractors	Field Activities	With the exception of subcontractors specifically identified above as part of the management team, subcontractors will be responsible for their own HASPs. However, even sampling support subcontractors are required to maintain a corporate-level or site-specific HASP that covers field sampling and investigation activities. HASPs must meet or exceed the minimum requirements identified by OSHA 29 CFR 1910 and 1926. Subcontractors must ensure the developed HASP complies with the minimum requirements associated with this HASP, including using the proper personal protective equipment (PPE), reporting unsafe acts and conditions, and following the work and safety and

Name	Role	Responsibility
		health instructions of the PM, SSO, and site-specific HASP and protocols

Note
All personnel requiring access to controlled work areas must have completed the appropriate training. If field personnel change, substitutions will be made with similarly qualified personnel.
TBD: To be determined
CFR: Code of Federal Regulations
HASP: Health and Safety Plan
Site: Former J.H. Baxter & Co. Wood Treating Facility Site

Any modifications to this HASP will be recorded in Section 2.4, Table 4, of this HASP.

2.2 Stop Work Authority

All workers have "Stop Work Authority" to immediately stop work if they believe that a particular task is being performed in an unsafe manner. This authority may be exercised at any time by anyone working at the Site without repercussions or retribution. If individuals observe hazards for which they are unprepared, they will withdraw from the area to reevaluate the task and develop appropriate safety precautions before proceeding. The GSI Site Safety Officer will be contacted to determine next steps and this HASP will be revised accordingly.

2.3 Limitations

This HASP was prepared exclusively for the J.H. Baxter & Co. by GSI in accordance with OSHA 29 CFR 1910 and 1926, and the GSI Health and Safety Policy (GSI, 2020). This HASP covers known field hazards associated with the tasks necessary to complete the Remedial Design contract. The quality of information herein is consistent with the level of effort required for GSI services and is based on (1) information available at the time of preparation; (2) data supplied by outside sources; and (3) the assumptions, conditions, and qualifications set forth in this HASP. This HASP is intended to be used by field personnel for sampling, surveying, technical field support to the client, and site reconnaissance only. Any other use of, or reliance on, this HASP by GSI or any third party is at that party's sole risk.

The information contained herein is relevant to Site conditions known at the time of the HASP development. In the event that changes in the nature, usage, or layout of the property or nearby properties are made, the information contained in this HASP may not be valid. If additional information becomes available, it should be provided to GSI to modify the HASP as necessary.

2.4 Approvals and Modifications

Former J.H. Baxter & Co. Wood Treating Facility or a designated representative is responsible for the approval of this plan and any future modifications after preparation. Modifications will be documented in Table 4.

Table 4. Record of Modifications and Version Control

Section Revised	Page #	Description of Changes	Author	Date Issued	Reviewed By

SECTION 3: **Site Description and Scope of Work**

3.1 Site Description

The Site is located at 6520 188th Street NE, Arlington, Washington. Figure 1 shows the entire Site and points for access and emergency evacuation.

Staff will not enter the Former J.H. Baxter & Co. Wood Treating Facility without pre-approval from J.H. Baxter & Co and the current facility operators. The road leading to the Former J.H. Baxter & Co. Wood Treating Facility has a controlled access gate that will require a key, when locked. The PM will coordinate access with designated site representatives, prior to commencing work.

3.2 Scope of Work

This HASP covers actions to be taken to implement the sampling activities for the Site, which may include site reconnaissance, contractor oversight, potential drilling activities, multimedia (soil and groundwater) sampling, sample processing, and bench studies.

3.3 Locations of Nearest Facilities

The locations of facilities such as restrooms are noted in Table 5.

Table 5. Locations of Nearest Facilities

Facility	Notes
Telephone	Employees should keep fully charged cell phones on-site. For remote sites or extended field days, it is recommended that a car charger or fully charged power block be available. For overwater work, radios will be used as a backup communication method.
Water Source	Employees will be provided access to clean drinking water. The SSO will ensure that a sufficient water supply is maintained.
Restroom[1]	Location will vary and will be identified in the field before work commences.
Personal Hygiene[1]	Hand wash stations, hand washing water and soap, and/or hand wipes will be supplied at all times. Personnel must not eat food, drink, or smoke around work areas.

[1] Note that Attachment 10, Novel Coronavirus Guidelines, includes specific protocols to follow for sanitation and hygiene to prevent the spread of Coronavirus Disease 2019 (COVID-19). These protocols must be followed until the Consultant Project Manager or designee indicates otherwise.

SSO: Site Safety Officer

3.4 Site Access

Vehicle access to the Site is from 188th Street NE. A parking lot will serve as the entrance to the Site (Figure 1).

3.4.1 Operational Hours

Operations at the Site will be determined during the scheduling of work activities and in coordination with J.H. Baxter & Co. Site access is upon prior approval only. Site activities should limit interference with active

wood treating operations to the extent possible and coordinate on timing and work area to avoid conflict with operations. This may include night work to prevent conflict.

3.4.2 Visitor Access and Safety

All field employees and project-area visitors must check in with the PM, participate in a brief safety overview (if new to the facility), sign off that they have received the safety overview, and sign in and out on the plant visitor log before proceeding to the field. The visitor log will be maintained by the current plant operator.

SECTION 4: **Safe Work Practices**

As much as possible, all field activities will be conducted during daylight hours. However, as it is possible some of the work may occur during periods of short daylight hours or at night. If this occurs, support lighting will be required when work is conducted in areas without sufficient facility lighting. Work hours should be limited to no more than 60 hours per week with at least one day off per week and no more than 12 hours per day worked without pre-approval by the PM.

4.1 Accident Prevention

The SSO and all employees will inspect the work area and/or Site daily to identify and correct any unsafe conditions. Field personnel and subcontractors should inspect the work area thoroughly before leaving the Site. Adherence to the safe work practices and procedures outlined in this HASP and attachments will assist with accident prevention.

Access will be limited to all controlled areas via the prescribed administrative (certifications) and engineering (barricades) controls, as described above. All project-area staff and visitors will note arrival and departure times on a field log maintained by the SSO.

- All unsafe conditions will be corrected immediately. All unsafe conditions not in the scope of the project will be reported to the SSO and the condition corrected.
- Loose-fitting clothing and loose long hair are prohibited near moving machinery.
- Where portable electric tools and appliances can be used (where there is no potential for flammable or explosive conditions), they will be equipped with three-wire grounded power and extension cords to prevent electrical shock. Use of a ground-fault circuit interrupter (GFCI) to prevent electrical shock is required.
- Store tools in clean, secure areas so that they will not be damaged, lost, or stolen.
- All equipment, tools, and property will be secured, as needed, at the end of each day.
- Maintain good housekeeping practices to prevent slips, trips, and falls.

4.2 Personal Conduct

- Unauthorized personnel are not allowed at the Site.
- A high standard of personal hygiene will be observed. Smoking, eating, drinking, chewing gum or tobacco, taking medication, and applying cosmetics will not be permitted within the Exclusion Zone (EZ) or Contamination Reduction Zone (CRZ).
- Personnel under the obvious influence of alcohol or controlled substances are not allowed at the Site; those taking medications that could impact ability to safely perform work must notify the SSO before beginning work.
- All Site personnel will familiarize themselves with Site safe work practices and the emergency procedures during daily tailgate and pre-work safety meetings.
- No “horseplay” or unsafe actions or activities will be allowed.

4.3 Vehicular Use

The following requirements shall be observed when operating and in the vicinity of motor vehicles:

- On public roads, adhere to traffic regulations and speed limits.
- Within the Site boundaries, comply with site requirements for motor vehicles.

- Inspect the driving area for access, soft ground, and obstacles or sharp objects that may damage the vehicle.
- Where possible, move the vehicle to be close to the sampling location.
- If possible, drive in and out of the location, rather than reversing. If reversing is necessary, use a spotter as a guide.
- Use wheel chocks when parked on steep slopes.
- Before exiting a vehicle, shift into park, set the parking/emergency brake, and shut off the engine.
- Never leave a running vehicle UNATTENDED.
- Do not fuel engines while the vehicle is running.
- Install adequate roads, signs, lights, and devices, where applicable.
- Cell phone use while driving is not permitted.
- Employees who are passengers or drivers of vehicles will wear their seat belts any time the vehicle is in motion.

4.4 Slips/Trips/Falls

Good housekeeping practices should be used at all times to minimize trip hazards and falls. Extra caution should be taken when work on unstable surfaces, uneven terrain, steep grades, and elevated surfaces cannot be avoided. Fall protection must be provided when working on heights of 6 feet or more. Refer to OSHA fall protection requirements for varying heights and conditions. Refer to the Information on Slips, Trips, and Falls fact sheet for further information (Attachment 3).

4.5 Blood-borne Pathogens

First aid responders have the potential to be exposed to blood-borne pathogens. The potential for exposure to blood-borne pathogens exclusive of an emergency response is not anticipated. When rendering first aid in situations where exposure to bodily fluids or blood may occur, responders will wear, at a minimum, latex or nitrile gloves, and a face shield or safety glasses. Employees are not required to administer first aid. Employees are required to immediately assess any emergency situation and seek professional assistance as appropriate.

4.6 Subsurface Utilities

Check for the location of underground services before beginning ground-penetrating work. OSHA regulations require the estimated location of utility installations (sewer, telephone, fuel, electric, water lines or any other underground installations that reasonably may be expected to be encountered during excavation work) will be determined before opening an excavation.

Use a service locator and the following cues to assist in identifying possible underground services: (1) signs of patched or missing of pavement; (2) service boxes, pits, and manholes (as they may indicate the presence or alignment of services); and (3) services coming into or out of the ground, such as power lines and downspouts. When possible, shut off utilities in the area while ground-penetrating work is taking place. Consider less-intrusive boring methods for shallow soil, such as using a vacuum truck/air knife or hand auguring to a given depth below surface for physical confirmation of absence/presence of utilities. Ensure upland drilling complies with the client's or adjacent property owner's intrusive work requirements, when policy exists.

4.7 Machinery/Mechanical Equipment/Heavy Equipment

Stand clear of operating machinery and be familiar with emergency stop devices, if applicable. No loose clothing shall be worn and all long hair (extending below the shoulders) shall be tied back. Safety vests must be fastened at the front. Stay clear of hoisting operations (drill rod attachment and detachment). Be aware of all pinch points and provide guarding where possible. Be aware that heavy equipment activity may change daily or hourly, with differing potential hazards to be identified and addressed. Maintain eye contact with operator and wait for clearance before entering an active work zone.

4.8 Overhead Hazards

Look up to determine the location of hazard(s). If overhead hazards exist, change the location of the work to be performed where possible, otherwise, secure the overhead hazard(s) (e.g., de-energize live electrical lines). Stand clear of drill rig and facility operations. Do not walk under a raised load or a load supported by a winch. Stand uphill from drilling activities (if possible), as falling drill strings may roll.

4.9 Manually Lifting Hazards

Assess the load to be lifted, loaded, pushed, or pulled. Solicit help if the load cannot be safely moved by one person or if handling the load is too awkward. Consider breaking loads into pieces and taking multiple trips. Lift with the knees and hold load close to body. Make sure footing is firm, the path is clear, and avoid twisting. Use these techniques when setting a load down.

4.10 Sharp Objects

Sharp objects are broadly defined; the potential hazards are specific to each work area. Sharp objects may include, but are not limited to, nails, exposed metal edges, metal shards, exposed rebar, broken glass, and sharps. Employees should look for and scan the work area for the presence of sharp objects to avoid contact (such as stepping or sitting on the sharp objects) and potential injury. Remove or protect other workers from exposure to hazards from sharps, where possible and safe to perform. Particular care should be taken in areas where debris is present. If sharps are present, steel-shanked boots should be considered where they provide increased worker protection. Leather gloves should be worn at all times when moving or coming into contact with materials that pose a cut or puncture risk. When possible, use tools such as rakes and shovels to avoid direct handling of debris when moving it.

4.11 Noise Reduction

Project-area activities in proximity to welding, construction, and heavy equipment often expose workers to excessive noise. It is anticipated that situations may arise in which noise levels may exceed the OSHA Action Level of 85 decibels (A-weighted scale) in an 8-hour time-weighted average. For example, working in close proximity to the subcontractor during drilling or trenching activities at the Site may pose this risk. If excessive noise levels occur, earplugs with the appropriate Noise Reduction Ratings will be issued to all personnel and a system of hand signals understood by all will be implemented (see Section 11). Refer to Preventing Hearing Loss Caused by Chemical (Ototoxicity) and Noise Exposure (Attachment 4).

4.12 Sanitation

Potable drinking water will be supplied in tightly closed containers and will be clearly marked for its intended use. If vehicles are available for use by field crews, restrooms and a field washing area with potable water will be available within a reasonable distance from the Site. If sanitary facilities are not located within a reasonable distance, portable facilities will be installed for use by field employees.

Note that Attachment 10, Novel Coronavirus Guidelines, includes specific protocols to follow for sanitation and hygiene to prevent the spread of Coronavirus Disease 2019 (COVID-19). These protocols must be followed until the Consultant Project Manager or designee indicates otherwise.

4.13 Illumination

When fieldwork is to be conducted before dawn or after dusk, or when light conditions are less than 5 foot-candles, illumination in all Sites and access pathways to those areas will be maintained with facility lighting, temporary light plants, equipment-mounted lighting systems, or similar equipment, such that illumination at 5 foot-candles or above is provided. When and where possible, walking and working surfaces should be cleared before engaging in low-light activities.

4.14 Weather Conditions

Weather is always a potential safety factor in performing work in outdoors. To ensure worker safety, the minimum safety rules outlined in Sections 4.16.1 through 4.16.4 will be implemented. Modification of work limitations due to weather can only be approved by the SSO or PM.

4.14.1 Lightning

The 30-30 rule is a common rule used for lightning safety and is defined as follows: If lighting is seen, count to 30 seconds. If thunder is heard within 30 seconds (assumes lighting is within 6 miles), workers will shelter in place. Workers in the uplands will shelter in buildings or vehicles. Workers performing overwater work will shelter in the cabs of overwater platforms, tugs, or vessels. Sheltering in place will end 30 minutes after the last lighting with thunder occurring within 30 seconds. Weather apps such as Spark can also be used to determine whether lightning is within 6 miles of the Site. Refer to Lightning Safety When Working Outdoors (Attachment 5).

4.14.2 High Winds

Work will be stopped when sustained winds of more than 15 miles per hour (mph) and/or gusts of over 25 mph occur, unless prior approval is provided by the SSO.

4.14.3 Heat Stress/Heat Stroke

Workers must drink plenty of fluids (not caffeinated), and wear clothing and sunblock as appropriate for the weather conditions. The SSO or designee will monitor workers for signs of heat stress. The heat index may be verified using a wet-bulb thermometer in high-humidity conditions. Remember that humidity on the water may be higher than weather station humidity reports. Refer to Protecting Workers from the Effects of Heat (Attachment 6).

4.14.3.1 Training

The SSO is responsible for implementing the Thermal Stress Prevention Program, monitoring project- area heat conditions and worker physiological parameters, and for ensuring that employees are trained to recognize the signs and symptoms of heat stress illnesses or injury and understand what to do if these occur.

4.14.3.2 Program Implementation Criteria

Work activities will be limited, reduced, or halted when humidity is greater than 80 percent and temperatures are greater than 90 degrees Fahrenheit (°F), or when temperatures are greater than 100 °F, regardless of humidity. Above 85°F, a cooling shelter (i.e., a location out of direct sunlight) shall be provided,

and additional rest cycles and personnel monitoring must be considered. Final direction on work and work support will be provided by the SSO. Refer to Protecting Workers from the Effects of Heat (Attachment 6) and Protecting Workers from Heat Stress (Attachment 7).

4.14.3.3 Heat Stress Management

Work practices and exposure controls are used to reduce the risk of elevating an employee's core body temperature. These work practices and exposure controls include the following:

- Defining and adjusting employee work/rest intervals
- Monitoring for physiological signs of heat stress
- Providing cool liquids
- Establishing and implementing acclimatization schedules
- Using warm-weather cooling garments

4.14.3.4 Employee Work/Rest Intervals

Work/rest intervals are based on the personal protective equipment (PPE) worn, employee work loads, environmental conditions (temperature, humidity, air movement), and the results of physiological monitoring. Work/rest intervals are determined by the SSO and communicated to employees. Work/rest intervals are adjusted throughout the work shift as needed and communicated to each employee at the conclusion of an applicable rest period, prior to reentry into the work zone.

4.14.3.5 Monitoring

Physiological monitoring is conducted to alert employees and their supervisors to potential heat stress illness. Initial monitoring is conducted and documented by the SSO at the beginning of the work shift, prior to entry into the work zone, when required. Additional physiological monitoring is performed at the beginning and end of each rest cycle. Reentry intervals and readjustment of the work/rest cycle are determined based on the state and federal guidelines. Physiological monitoring may include measuring the heart rate, recovery heart rate, oral or ear-canal temperature, or percentage water loss.

Physical signs and symptoms of heat stress are discussed with employees at the start of the project and reviewed as necessary. Employees monitor each other's actions, speech, and appearance for signs and symptoms of heat-related illnesses. Symptoms of heat-related illnesses are described in Protecting Workers from the Effects of Heat (Attachment 6) and Protecting Workers from Heat Stress (Attachment 7). Employees exhibiting signs or symptoms of heat exhaustion should be moved to shade or air conditioning, given cold water, and monitored by another employee. Heat stroke is a life-threatening emergency. If heat stroke is suspected, emergency services should be called immediately.

4.14.3.6 Liquid Replacement Program

Since dehydration is a primary cause of heat-related illness, employees should ensure regular hydration is performed prior to and during workdays with elevated temperature conditions as described in Section 4.16.3.2, Program Implementation Criteria. A liquid replacement regime is not based on thirst. Employees need enough liquid and electrolytes to maintain their normal body weight throughout the day. Some sports drinks may exacerbate problems for some employees with certain medical conditions. Carbonated beverages are not recommended as a primary beverage for replacing body fluid because many contain caffeine and/or the carbonation makes the beverages difficult to drink in large quantities.

4.14.3.7 Acclimatization Program

Acclimatization increases physical tolerance to warm climates by improving the circulatory system and balance of salt in the body. Employees that are newly hired, have not worked in a comparable environment during the previous week, or have been away from the Site (due to vacation or sickness) should ensure they are properly acclimated prior to excessive exertion. Employees need time to become acclimatized—usually about 7 days. Acclimatization may start to decline in as little as 4 days. Alcohol or other drugs may affect the body's ability to acclimatize.

4.14.4 Cold Stress/Hypothermia

Drink plenty of fluids (not caffeinated), wear clothing appropriate for the weather conditions, and wear multiple layers. Avoid cotton clothing when possible. Monitor workers for signs of cold stress. Refer to Protecting Workers from Cold Stress (Attachment 8).

Freezing temperatures as defined as <35°F, as some areas freeze at higher air temperatures higher than 32°F. Check local weather for wind chill ("real-feel") conditions. No overwater work will be performed when temperatures are below freezing without prior approval by the SSO. If work occurs in conditions of below-freezing temperatures, salt or ice melt should be used on overwater platform, barge, and vessel decks and extreme care must be taken to prevent slips, trips, and falls. Upland work will be performed with pre-approval by the SSO only.

4.15 Electrical Hazards

Electrical equipment should be inspected to ensure it is in safe working order before use. Equipment should be grounded and operated under dry conditions. Where portable electric tools and appliances can be used (in areas where there is no potential for flammable or explosive conditions), they will be equipped exclusively with three-wire grounded power and extension cords to prevent electrical shock. Use of a GFCI is required to prevent electrical shock.

4.16 Unknown Chemical Exposure

Work will be stopped if visual or olfactory observations indicate unanticipated conditions. Worker PPE will be reassessed and the SSO will determine whether additional personnel monitoring is required before resuming work.

4.17 Hot Work

No hot work shall be performed in the Site. Contact the SSO or PM if hot work is required.

SECTION 5: **Training Program**

All GSI employees and subcontractors performing work under GSI's HASP or a HASP consistent with GSI requirements are required to have the following training to be working in the Site (Table 6). Copies of training certificates and training records will be kept at GSI's Portland office. Field projects will not be approved to take place in the absence of adequate documentation.

Table 6. Training Requirements

Type of Current Certificate	Yes	No	Trained Field Employees
HAZWOPER 40-Hour	X		Required for all GSI and subcontractor field personnel working on HAZWOPER projects. Any other subcontractors performing limited work efforts must be escorted by trained employees and/or avoid contact with potentially impacted materials. See the GSI SSO to determine minimum training for limited work efforts.
HAZWOPER Annual 8-Hour Refresher	X		Required for all GSI and subcontractor field personnel working on HAZWOPER projects. (The annual 8-hour training is required after a worker has had the 40-hour certification for one year). Same requirements as the 40-hour training for subcontractors performing limited work efforts.
HAZWOPER Supervisor Training	Employee-Specific		Supervisors and the SSO will have completed the above and an additional 8 hours of OSHA Management and Supervisory Training.
First Aid/CPR/AED	X		Required for all field personnel. First aid/CPR/AED training is provided to allow employees to voluntarily administer first aid or medical assistance to family, friends, or coworkers as Good Samaritans.[1] Field employees are not required to administer first aid. Field employees are required to immediately assess any emergency situation and seek professional assistance as appropriate.

Notes

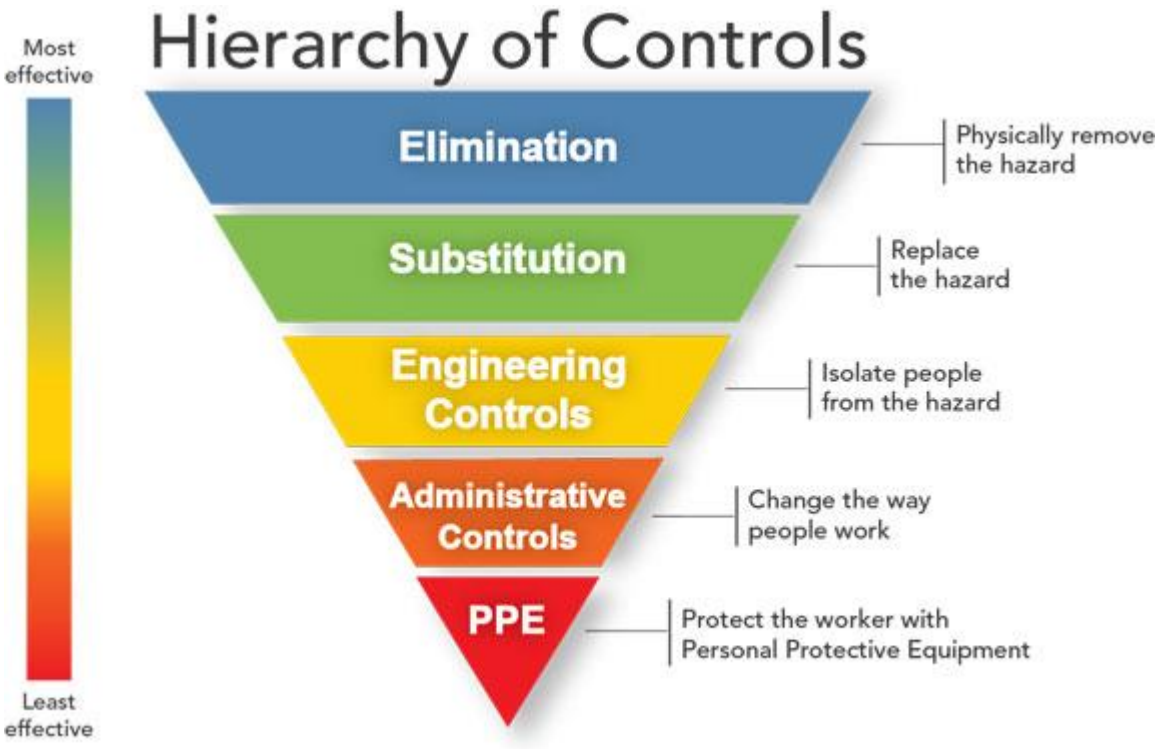
[1] The "Good Samaritan" statutes in Washington (RCW 4.24.300) maintains that people who provide emergency medical assistance without the expectation of compensation (i.e., acting as Good Samaritans) are not liable for damages for providing the emergency medical assistance.

AED: automated external defibrillator
CPR: cardiopulmonary resuscitation
GSI: Groundwater Solutions, Inc.
HAZWOPER: Hazardous Waste Operations and Emergency Response
OSHA: U.S. Occupational Safety and Health Administration
SSO: Site Safety Officer

SECTION 6: **Site Controls**

6.1 Hierarchy of Controls

Best practices for safe working environments include implementing a hierarchy of controls that, when used together, can provide redundant and/or complementary layers of protection for workers. Controls at the top of the hierarchy, such as elimination of the hazard, are potentially more effective and protective than controls at the bottom (see below).



In some cases, using controls closer to the top of the hierarchy may reduce the intensity of the controls at the bottom, thus reducing the possibility of corollary risks. For example, eliminating an exposure risk may reduce the requirement for a Tyvek[1] coverall—the use of which requires monitoring for thermal stress.

Because elimination or substitution of hazards may not be feasible at the Site, engineering controls (such as barriers and additional ventilation) may be needed to reduce exposure. Thermal control measures are an example of administrative control over how a task is done. PPE, while most common, is the least effective control in some cases and should be the LAST OPTION for minimizing exposure to hazards.

6.2 Management of Change

This HASP is intended to be site-specific and therefore responsive to actual site conditions, contract requirements, regulatory requirements, hazards, scope of work, and related conditions. For any number of reasons, it may be necessary to re-assess and revise plans. GSI detects changing, unrecognized, or new conditions through key processes such as project-area monitoring, employee observations, and inspections. Routine changes in conditions are addressed through hazard analysis and revised plans.

[1] Tyvek is a registered trademark of DuPont.

6.3 Work Zones

Work zones are defined below. In the case of limited space, the CRZ and EZ may be combined. Work zones will be defined and labeled once work areas have been confirmed.

All project-area visitors (except OSHA inspectors) must receive prior approval from the SSO or PM and may do so only for the purposes of observing project-area conditions or operations.

6.3.1 Support Zone (SZ)

The support zone (SZ) will be located away from the contaminated area. Vehicles, emergency equipment, the telephone and break area, and any non-essential personnel will be located in this area. SZ areas for the Former J.H. Baxter & Co. Wood Treating Facility includes the parking lot near the entrance of the site and will be defined once field work begins by the SSO.

6.3.2 Contamination Reduction Zone (CRZ)

Decontamination boundaries will be established for personnel and sampling equipment in the CRZ using caution tape or ropes. The boundaries will isolate personnel allowed in the SZ from workers in the EZ. Only one or two points of egress from the EZ (see Section 6.3.3) should be established to control access and limit the locations where potential decontamination is required. Decontamination supplies must be established at the CRZ prior to starting work. Personnel and equipment will pass from the EZ through the CRZ to the SZ. Coolers in this zone will be protected from contamination and decontaminated before leaving the CRZ.

6.3.3 Exclusion Zone (EZ)

The EZ is defined around intrusive activities or located in the immediate hazard area. The EZ is often identified by cones, caution tape, or other means to notify unauthorized individuals of the presence of potential hazards. Access should be restricted to field sampling crews and necessary equipment operators.

6.4 Barriers and Signs

Barricades, traffic cones, and/or markings or caution tape will be used at a safe distance from excavations, pits, hazardous areas, driller working areas, and moving equipment to prevent unauthorized access to work areas from vehicular and pedestrian traffic. Barriers will be appropriate for the level of work activity and anticipated traffic. Signage or work boundary delineation will be installed as necessary.

6.5 Potential Chemical Hazards and Controls

Based on potential activities to be conducted at the Site or adjacent to the Site, chemicals or classes of contaminants of concern (COCs) identified onsite or have a possibility to be present onsite in soil and groundwater include the following:

- Nonaqueous phase liquids (NAPL)
- Pentachlorophenol (PCP)
- Polycyclic aromatic hydrocarbons (PAHs)

Chemicals used on this project for decontamination purposes include:

- Alconox detergent or similar

Hazardous material container(s) must be properly labeled with the identity of the hazardous chemical(s) and appropriate hazardous warning information. The SSO will obtain copies of safety data sheets (SDSs) for any

hazardous materials in use at the Site. The SDSs will be attached to this HASP as Attachment 9. The SSO will orient GSI employees and subcontractors to the potential hazards posed by chemicals used and present onsite.

6.6 Potential Chemical Exposure Pathways

The primary routes of exposure for Site chemicals include skin contact with contaminated materials and ingestion of materials from hand-to-mouth contact due to inadequate personal hygiene. To minimize these exposure pathways, all required PPE—as determined by the activity hazard analyses (AHAs)—will be worn and personal hygiene will be carefully monitored. AHAs will be developed by the SSO upon approval of the Pre-Design Investigation Work Plan and prior to commencing work. AHAs will be attached to this HASP. See Section 12.1 for more information.

SECTION 7: **Medical Monitoring**

Field employees anticipated to spend more than 29 days at Hazardous Waste Operations and Emergency Response (HAZWOPER) sites or required to wear an air-purifying respirator are enrolled in a HAZWOPER Medical Monitoring Program. The use of air-purifying respirators is not anticipated. If required, field personnel must be fit-tested and approved by an occupational health physician (see next section) for respirator use prior to donning in the field.

7.1 Periodic Comprehensive Exam

All personnel requiring access to controlled work areas will have completed a baseline medical examination and a periodic (usually annual) medical examination before assignment, in accordance with the OSHA 29 CFR 1910.120(f). The exam must be performed by an occupational health physician, who will provide written clearance for air-purifying respirator usage and hazardous waste site work. Protocols for the baseline, periodic, and exit exams must be at least as stringent as those defined in the GSI's Medical Monitoring Program.

7.2 Medical Clearance Record Keeping

Medical clearance documents are on file at GSI's office in Portland, Oregon. To ensure confidentiality, results of the medical exams or treatment records are maintained at the medical care provider's clinical offices.

7.3 Exposure Monitoring

No specific personnel exposure monitoring is required at this time. This HASP will be modified, as needed to discuss exposure monitoring.

SECTION 8: **Personal Protective Equipment**

8.1 Levels of Protection

Initial levels of protection for the Site may vary depending on the task. All personnel entering controlled work zones initially will be required to wear the U.S. Environmental Protection Agency (EPA)/OSHA-approved level of protection as specified in this plan in Table 7.

Protection may be upgraded or downgraded depending on monitoring data (compared with action levels) and project-area conditions, as determined by the SSO. Table 7 and the following sections outline the minimum guidelines for each level of protection that is assigned or potentially assigned.

Table 7. PPE to be Used at the Site

Personal Protective Equipment[1]	Field Work	Sample Processing
Steel-toed boots (leather or neoprene safety, slip- and chemical-resistant, waterproof)	X	X
Steel-shanked boots should be considered where they provide increased worker protection against a cut or puncture risk	X	X
Gloves (such as leather or nitrile)	X	X
Eye/face protection (safety glasses, goggles, or face shield)	X	X
Hard hat	X	X
Splash protection (polyvinyl chloride [PVC] bibs/aprons, or Tyvek coverall)		As necessary
Hearing protection	As necessary	As necessary
Clothing (long pants and shirts with sleeves; cold-weather gear, rain gear, as appropriate)	As necessary	As necessary
Heavyweight rain gear (if raining)	As necessary	As necessary
Personal flotation device (Type II)		

Note
[1]During sampling activities, workers will wear gloves and personal protective equipment (PPE) appropriate for the expected contaminants that may be encountered. When selecting PPE, consider potential exposure routes associated with the contaminant (e.g., inhalation, ingestion, skin contact).

8.2 Chemical Splashing

Care should be taken during sample collection activities to prevent liquids from splashing onto skin, clothing, and face. Sampling equipment should be handled carefully (e.g., placed, opened, moved) to prevent splashing. If splashing occurs, the area should be rinsed with clean water and dried, when possible. Safety glasses should be worn during sampling activities and during any activities with splash potential. Consider goggles or face shields and aprons where hazardous liquids are used, if applicable.

8.3 PPE Failure/Chemical Exposure

In the event of PPE failure, the worker and/or buddy will cease work, perform personal decontamination procedures (Section 9), and exit to the SZ/CRZ. Refer to the SDS (Attachment 9) and Section 1 if emergency medical response is needed. If chemicals contact the eyes, irrigate for 15 minutes and consult a physician.

8.4 PPE Inspection, Storage, and Maintenance

Reusable PPE will be decontaminated, inspected, and maintained, as necessary after each use. Personal equipment (e.g., hard hat, steel-toed boots) will be properly stored by the employee/subcontractor. The SSO will periodically inventory the disposable and reusable PPE at the Site and will replenish stocks in a timely manner.

SECTION 9: **Decontamination and Disposal Procedures**

Procedures for the decontamination of sampling tools and other related equipment will be specified in Field Sampling Plans (FSPs) and/or Quality Assurance Project Plans developed. General procedures are summarized in Table 8 below. Note that separate areas should be established for personnel, sampling, and heavy equipment decontamination (discussed in Section 6.3).

9.1 Personnel Decontamination Procedures

Field personnel will wash hands and face after removing PPE. Steps for personnel decontamination in defined EZs and CRZs are listed in Table 8.

Table 8. Equipment and Procedures for Personnel Decontamination

Equipment	Decontamination Solution	Procedures	
		Intermediate[1]	Final[2]
• Long-handled, soft-bristled brushes • Galvanized wash tubs or equivalent • Pump-activated sprayer • Garbage cans with plastic liners and drums with liners • Plastic sheeting • Paper towels • Duct tape	• Alconox or similar • Tap water for rinsing	1. Dispose of or wash outer boots and gloves with Alconox solution. 2. Rinse outer boots and gloves. 3. Remove outer gloves. 4. Enter CRZ for sample management. 5. Return to EZ wearing new or cleaned outer gloves.	1. Segregate equipment (for instruments and equipment requiring special decontamination; see the FSP). 2. Dispose of or wash outer boots and gloves with Alconox solution. 3. Rinse outer boots and gloves. 4. Remove and dispose of outer boots. 5. Remove and dispose of outer gloves (if not cleaned to “like new” condition). 6. Remove and dispose of coverall. 7. Remove and dispose of inner gloves in designated receptacle. 8. Field wash for personal hygiene. 9. Exit to SZ.

Notes
[1]Intermediate decontamination is for periodic exits from the EZ during sample transport and management or for short breaks.
[2]Final decontamination is performed before eating, when taking cool-down breaks, and when exiting the Site.
CRZ: Contamination Reduction Zone
EZ: Exclusion Zone
FSP: Field Sampling Plan
SZ: Support Zone

9.2 Equipment Decontamination

All equipment that will potentially contact samples will be decontaminated before and after sampling events according to procedures specified in the FSP. Heavy equipment in direct contact with sediments, soil, and/or water, such as the drill rig augers and backhoe buckets, will be decontaminated by the subcontractor.

9.3 Emergency Decontamination

In the event of an accident or incident in which work must cease and staff must exit the EZ, emergency decontamination should be performed to the greatest extent feasible. In an emergency, the primary concern is to prevent the loss of life or severe injury. If immediate medical attention is required to save a life, decontamination should be delayed until the victim is stabilized. If the decontamination can be performed without interfering with essential life-saving techniques or first aid, or if a worker has been contaminated with an extremely toxic or corrosive material that could cause severe illness or loss of life, decontamination must be performed immediately. If an emergency resulting from a heat-related illness develops, protective equipment should be removed carefully from the victim as soon as possible.

Any time emergency decontamination methods must be used, an incident report (see Attachment 1) must be completed by the SSO and submitted to GSI's Safety Committee.

9.4 Disposal Procedures

Soils and wastes generated from sampling events will be characterized in advance to determine appropriate disposal procedures. Waste PPE, including used nitrile gloves, will be contained in garbage bags and disposed with common waste. All visibly impacted soil or sediments and water generated during drilling and sampling will be contained in 55-gallon drums and drummed materials will be profiled to evaluate disposal options. Construction of temporary waste collection stations, when required, will be the responsibility of the SSO.

SECTION 10: **Spill and/or Discharge of Hazardous Materials**

10.1 Training

Responses to incidental releases or spills of hazardous substances that can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area are not considered to be emergency responses under 29 CFR 1910.120(l) and do not require additional specialized training.

10.2 Spill Control and Response

There is a potential for incidental spillage/leakage of hazardous materials, if present. Store these materials properly and maintain the appropriate spill response equipment in the area where the materials are used/stored. In case of incidental spills or leaks, follow these steps:

1. Notify the SSO as soon as possible.
2. Select appropriate PPE and response equipment.
3. Contain the spill to the extent possible.
4. Neutralize or solidify the liquid per the SDS.
5. Transfer the material to an appropriate compatible container.
6. Document with an incident report (see Attachment 1).
7. PM will notify the client.

10.3 Discharge Control and Response

In the event of an uncontrollable discharge of hazardous material from a structure (e.g., impoundment or tank), the PM will immediately contact the client to coordinate implementation of the client's Emergency Response Plan. Field personnel shall not assist in emergency response activities but will evacuate to the upland SZ or the emergency evacuation point for in-water work (see Figure 1).

10.4 Spill Response Reporting

Although spills in reportable quantities are not anticipated, field personnel will be instructed on the requirements and procedures for reporting to state emergency response agencies and the National Response Center (NRC) (contact information is in Table 1 in Section 1.1 of this HASP). Spills will be reported immediately after the safety of onsite personnel has been secured. Potentially reportable spills include any amount of oil/diesel/gas spilled in water, or more than 42 gallons of oil spilled on land. When reporting to the NRC, include the following information:

1. Your name and company
2. Your telephone number
3. Type of incident and the materials involved
4. Location/time of incident
5. Background/how the incident occurred
6. On-scene contact and how to reach them
7. Severity of incident—threat to people, property, or the environment
8. Actions taken, such as containment and/or evacuation
9. Responsible party and telephone number

10.5 Evacuation Procedures

Expeditious evacuation routes to the SZ will be established daily for all work areas. Evacuation notification will be one long blast on a canned siren, vehicle horn, or direct verbal communication (see Table 9 in Section 11.4 below for nonverbal communication signals). Emergency drills should be performed periodically. Any additions to evacuation procedures require an update to this HASP.

In the unlikely event that an evacuation is necessary, all personnel will immediately proceed to the upland SZ or the emergency evacuation point for overwater work, decontaminating to the extent possible for personal safety based on the emergency.

SECTION 11: **Communications**

11.1 Kickoff Meeting

A project kickoff meeting will be conducted prior to the start of any project work.

11.2 Daily Tailgate Safety Meetings

Tailgate safety meetings will be conducted by the SSO each morning before work begins, or before the following:

- A change of work tasks or conditions
- When new employees join the crew
- If project-area conditions change unexpectedly
- When a specific task or location poses a safety hazard
- To review proper use of PPE

Topics of discussion will include work tasks and designated PPE, emergency procedures, evacuation routes, instruction in the use of safety equipment (as required), prior safety problems, and similar topics. These meetings must be documented in the field notebook or a Tailgate Safety Meeting Checklist (to be developed based on field efforts planned).

11.3 Buddy System

The "buddy system" will be used during field activities that involve potential exposure to hazardous or toxic materials, for overwater or near-water work and during any work within the EZ. Each person will observe his/her buddy for symptoms of chemical exposure, cold stress/hypothermia, or heat stress, and will assess any emergency situation and seek professional assistance as appropriate. A cell phone will be maintained at the Site for emergency use.

11.4 Emergency Communications

Table 9 presents emergency hand and horn signals that will be used, as necessary, where verbal communication is limited.

Table 9. Emergency Signals

Hand and Horn Signal	Meaning
Thumbs up	OK; understand
Thumbs down	No; negative
Grasping buddy's wrist	Leave Site now
Hands on top of head	Need assistance
Horn - one long blast	Evacuate Site
Horn - two short blasts	All clear; return to Site

SECTION 12: **Safety Planning and Observation**

12.1 Activity Hazard Identification and Analysis

GSI's AHA focuses on the relationship between the worker, the task, the tools, and the work environment. Once those relationships have been identified, project controls are implemented to eliminate or reduce job hazards to an acceptable risk level.

The AHA begins with an assessment of the environment in which the work will be performed and the tasks to be conducted. Tasks are reviewed or observed to identify hazards. Hazard identification is the product of a root cause analysis combined with a risk analysis. GSI's AHA examines the problems that could occur and assesses the likelihood that the problem will occur. The AHAs for the planned upcoming efforts will be attached to this HASP.

All employees will be expected to assess emergency conditions and have the authority to issue stop-work or evacuation instructions based on the situation and their best professional judgment. Emergency procedures will be discussed during daily safety briefings. Emergency evacuation may occur as the result of a medical emergency (life-threatening) or site condition (e.g., seismic event, spills, nearby train derailment

12.2 Behavior-Based Safety

The purpose of GSI's behavior-based safety observation procedure is to build the company's safety culture by exercising a process of making observations, reinforcing exemplary behaviors, and correcting unsafe conditions and at-risk behaviors.

SECTION 13: **Accident Reporting and Record Keeping**

13.1 In Case of Emergency Injury or Illness

IN CASE OF EMERGENCY: CALL 911 AS SOON AS POSSIBLE

13.2 In Case of Non-Emergency Injury or Illness

At the onset of a non-emergency employee work-related injury or illness, GSI employees should first notify the supervisor on duty, then notify WorkCare at (888) 449-7787. GSI management will be contacted by WorkCare following the initial report. The employee is required to report (to the GSI SSO) all work-related and all non-work-related injuries that may affect their ability to safely perform their job.

After the initial report, the SSO or other designated GSI employee will immediately contact the PM, SSO, or GSI Health and Safety Manager to conduct an investigation jointly with the PM. The SSO or PM will complete the Incident Report Form (Attachment 1). These completed reports must be transmitted to the Safety Committee within 24 hours of an occurrence; a PDF file is acceptable. The Safety Committee will submit the appropriate reports to GSI's Human Resources Manager (for Workers' Compensation), and OSHA (as applicable).

13.3 In Case of Near-Miss Incident

All "near-miss" incidents (incidents with high likelihood of resulting in injury, illness, significant spill, or property damage), even in the absence of a resultant incident, should be reported to GSI management using the Near-Miss Report Form (Attachment 2). This provides safety tracking metrics to improve project safety in the future.

13.4 Subcontractor Accident Reporting

The foreman or field supervisor of subcontracting crews will investigate and complete an injury/illness report (similar in content to either the GSI Incident Report Form or the Near-Miss Report Form [Attachments 1 and 2, respectively]) in accordance with their internal company policy. This report must be transmitted to GSI within 24 hours of an incident.

13.5 Environmental Incidents and Property Damage

In case of environmental incidents or property damage, an Incident Report Form (Attachment 1) will be prepared by the SSO. Any damage, loss, or theft of property (items/tools/equipment) will be reported to the PM.

SECTION 14: **References**

GSI. 2020. Health and Safety Policy. Prepared by the GSI Safety Committee for GSI Water Solutions, Inc.

SECTION 15: **GSI Safety Committee Members and Contact Information**

Table 10. GSI Oregon Safety Committee Members

Person	Role	Contact Information
Josh Bale	Chair (Employee Representative), H&S Manager, and HASP Administrator (Employee Representative)	Work: 971.200.8502 Cell: 530.276.4188
Kathy Roush	Management Representative	Work: 971.200.8527 Cell: 919.605.6644
Molly Monroe	Recorder	Work: 541.257.9002 Cell: 541.230.0578
Andrew Davidson	Employee Representative	Work: 971.200.8535 Cell: 773.817.4229
Andrew Wentworth	Employee Representative	Work: 971.200.8534 Cell: 510.593.0120
Laura Burgess	Employee Representative	Work: 971.200.8504 Cell: 503.544.0879
Owen McMurtrey	Employee Representative	Work: 541.257.9005 Cell: 541.740.5619
Jessica Letteney	Employee Representative	Work: 971.200.8524 Cell: 503.410.4431

Note
HASP: Health and Safety Plan

SECTION 16: **Signatures**

I have read, understood, and agree to abide by, the requirements presented in this Health and Safety Plan. I understand that if I recognize an unsafe condition affecting my work, I have the absolute right to stop work until the condition is corrected.

Name Printed	Signature	Date

ATTACHMENTS

ATTACHMENT 1

Incident Report Form

Incident Report

Use this form to document information about an accident or incident. Fill out an investigation report as soon as possible. Note: this form is for use within your company. It is not intended to replace DCBS Form 801: *Worker's and Employer's Report of Occupational Injury or Disease*.

Employee(s) name(s): .....

Time & date of accident/incident: .....

Job title(s) and department(s): .....

Supervisor or lead person: .....

Witnesses: .....

Brief description of the accident or incident: .....

.....

Body part affected: .....

Did the injured employee(s) contact WorkCare? ( ) Yes ( ) No

Did WorkCare recommend the employee seek medical attention? ( ) Yes ( ) No

Did the injured employee(s) see a doctor? ( ) Yes ( ) No

If yes, did you file an employer's portion of a worker's compensation form? ( ) Yes ( ) No

Did the injured employee(s) go home during their work shift? ( ) Yes ( ) No

If yes, list the date and time injured employee(s) left job(s): .....

Supervisor's Comments: .....

.....

What could have been done to prevent this accident/incident? .....

.....

Have the unsafe conditions been corrected? ( ) Yes ( ) No

If yes, what has been done? .....

If no, what needs to be done? .....

Employer or Supervisor's signature:

Date:

Additional comments/notes: .....

.....

GSI Water Solutions, Inc.
NEAR-MISS REPORT

1. Name of Employee Involved	**2. Date of Near-Miss**	**3. Time of Near-Miss**

4. Location/Site of Near-Miss Event

5. Other witnesses present at time of near-miss

6. Length of time employed by GSI	**7. Employment Category**
☐ < 6 months ☐ 6 months – 1 year ☐ 1 – 2 years ☐ 2 – 5 years ☐ Greater than 5 years	☐ Regular, Full-Time ☐ Regular, Part-Time ☐ Temporary/Seasonal Employee ☐ Non-Employee
8. Familiarity with Activities related to Near-Miss	**9. Phase of Work Day when Near-Miss Occurred**
☐ First Time performing ☐ Observed but never performed ☐ Limited to some familiarity ☐ Regularly perform	☐ Performing Duties during Standard Hours ☐ During meal/rest period ☐ Prior to Starting or At End of Work Day ☐ Working Overtime/Long hours

10. Describe the near-miss:
Description of Event: What was employee doing just before and at the time of the near-miss?

11. What happened or what work conditions contributed to the near miss (e.g., Object/Equipment/Substance)

12. Outcome of near-miss:

13. Task and Activity at Time of Near-Miss:

General type of task:_____

Specific activity:_____

Employee was working:

☐ Alone ☐ With crew or fellow worker ☐ Other: _____

14. Was proper Ergonomic support utilized? Explain

15. Supervision at time of accident

☐ Unsupervised ☐ Supervised

☐ Limited Supervision

16. Factors that contributed to near-miss – Please check all that apply

Hazard

- ☐ Not recognized/identified
- ☐ Identified, but not addressed
- ☐ Inadequately addressed

Work Procedures

- ☐ None developed
- ☐ Not followed
- ☐ Partially followed
- ☐ Not understood
- ☐ Not appropriate
- ☐ Not communicated
- ☐ Other

Training & Certification

- ☐ Insufficient training
- ☐ Circumstances not covered
- ☐ Ineffective training
- ☐ Worker not authorized
- ☐ Outdated Training

Communication

- ☐ Breakdown in verbal communication
- ☐ Breakdown in written communication
- ☐ Confusion after communication
- ☐ Other_____

Other

- ☐ Weather/temperature
- ☐ Extended work hours
- ☐ Worker fatigue
- ☐ Physical overexertion
- ☐ Work in elevated area
- ☐ Chemical Use
- ☐ Biological agent
- ☐ Radiation
- ☐ Electricity
- ☐ Mechanical
- ☐ Animals

Facilities/Equipment

- ☐ Personal protective equipment
- ☐ Faulty equipment
- ☐ Poor/inadequate maintenance
- ☐ Inappropriate use
- ☐ Missing guards
- ☐ Obsolete/antiquated
- ☐ Inadequate design
- ☐ Ergonomic factors
- ☐ Equipment failure
- ☐ Trip hazard
- ☐ Slip hazard
- ☐ Struck by
- ☐ Other_____

Additional Comments:

ATTACHMENT 2

Near-Miss Report Form

GSI Water Solutions, Inc.
NEAR-MISS REPORT

1. Name of Employee Involved	**2. Date of Near-Miss**	**3. Time of Near-Miss**

4. Location/Site of Near-Miss Event

5. Other witnesses present at time of near-miss

6. Length of time employed by GSI	**7. Employment Category**
☐ < 6 months ☐ 6 months – 1 year ☐ 1 – 2 years ☐ 2 – 5 years ☐ Greater than 5 years	☐ Regular, Full-Time ☐ Regular, Part-Time ☐ Temporary/Seasonal Employee ☐ Non-Employee
8. Familiarity with Activities related to Near-Miss	**9. Phase of Work Day when Near-Miss Occurred**
☐ First Time performing ☐ Observed but never performed ☐ Limited to some familiarity ☐ Regularly perform	☐ Performing Duties during Standard Hours ☐ During meal/rest period ☐ Prior to Starting or At End of Work Day ☐ Working Overtime/Long hours

10. Describe the near-miss:
Description of Event: What was employee doing just before and at the time of the near-miss?

11. What happened or what work conditions contributed to the near miss (e.g., Object/Equipment/Substance)

12. Outcome of near-miss:

13. Task and Activity at Time of Near-Miss:

General type of task:_____

Specific activity:_____

Employee was working:

☐ Alone ☐ With crew or fellow worker ☐ Other: _____

14. Was proper Ergonomic support utilized? Explain

15. Supervision at time of accident

☐ Unsupervised ☐ Supervised

☐ Limited Supervision

16. Factors that contributed to near-miss – Please check all that apply

Hazard

- ☐ Not recognized/identified
- ☐ Identified, but not addressed
- ☐ Inadequately addressed

Work Procedures

- ☐ None developed
- ☐ Not followed
- ☐ Partially followed
- ☐ Not understood
- ☐ Not appropriate
- ☐ Not communicated
- ☐ Other

Training & Certification

- ☐ Insufficient training
- ☐ Circumstances not covered
- ☐ Ineffective training
- ☐ Worker not authorized
- ☐ Outdated Training

Communication

- ☐ Breakdown in verbal communication
- ☐ Breakdown in written communication
- ☐ Confusion after communication
- ☐ Other_____

Other

- ☐ Weather/temperature
- ☐ Extended work hours
- ☐ Worker fatigue
- ☐ Physical overexertion
- ☐ Work in elevated area
- ☐ Chemical Use
- ☐ Biological agent
- ☐ Radiation
- ☐ Electricity
- ☐ Mechanical
- ☐ Animals

Facilities/Equipment

- ☐ Personal protective equipment
- ☐ Faulty equipment
- ☐ Poor/inadequate maintenance
- ☐ Inappropriate use
- ☐ Missing guards
- ☐ Obsolete/antiquated
- ☐ Inadequate design
- ☐ Ergonomic factors
- ☐ Equipment failure
- ☐ Trip hazard
- ☐ Slip hazard
- ☐ Struck by
- ☐ Other_____

Additional Comments:

ATTACHMENT 3

Information on Slips, Trips, and Falls

FactSheet Slip, Trip, and Fall Prevention

Slips, trips, and falls account for a majority of general industry accidents. These accidents often cause lasting problems with daily activities, while 15% of these accidents are fatal. These incidents can be prevented through knowledge of common risk factors and the maintenance of a clean, safe work environment.

STEP 1: Be aware of the common risk factors for these injuries.

• Doorways	• Unsecured cables/cords in walkways
• Ramps	• Unguarded heights
• Cluttered hallways	• Unstable work surfaces
• Uneven surfaces	• Unsecured mats
• Areas prone to wetness or spills	• Smoke, steam, or dust obscuring your view
• Poor lighting	• Ladders
• Inattention to detail	• Stairs

What I need to do...

Notify my supervisor if or when I:

- Have problems walking or moving around.
- Experience frequent disorientation.
- Have vision problems that could prevent me from seeing hazards.
- Take medications that can cause dizziness.

STEP 2: Follow these tips to prevent slips, trips, and falls, and resultant injury.

1.	Clean up spills immediately.	**8.**	Remove tripping hazards from stairs and walkways.
2.	Stay off freshly mopped floors.	**9.**	Keep frequently used items in easily reachable areas.
3.	Secure any cords out of walkways.	**10.**	Check walkways and steps for obstructions.
4.	Use non-skid mats for slippery surfaces.	**11.**	Do not text while walking.
5.	Adjust gutter downspouts to drive water away from pathways.	**12.**	When using a ladder, always have at least three points of contact with the ladder.
6.	Wear shoes with good support and slip-resistant soles appropriate for the job task.	**13.**	Never stand on chair, table, or other surface on wheels.
7.	Ensure adequate lighting in work areas and hallways.	**14.**	Keep drawers/cabinet doors closed when not in use.

Inspect work areas monthly to identify hazards that could cause slips, trips, or falls. It is important that the indicated problems are addressed immediately.

References

National Safety Council: Slips, Trips, and Falls
http://www.nsc.org/NSCDocuments_Advocacy/Fact%20Sheets/Slips-Trips-and-Falls.pdf

OSHA Safety & Health Topics: Walking/Working Surfaces
https://www.osha.gov/SLTC/walkingworkingsurfaces/index.html

For more information on slip, trip, and fall prevention, contact the Office of Environmental Health & Safety at injuryprevention@usc.edu or (323) 442-2200.

USC Environmental Health & Safety

University Park Campus
3434 South Grand Ave, CAL 120
Los Angeles, CA 90089-2815

Health Sciences Campus
2001 N Soto St, SBA 329
Los Angeles, CA 90032

323.442.2200
injuryprevention@usc.edu
http://adminopsnet.usc.edu

08/2015

ATTACHMENT 4

OSHA Bulletin: Preventing Hearing Loss Caused by Chemical (Ototoxicity) and Noise Exposure

Preventing Hearing Loss Caused by Chemical (Ototoxicity) and Noise Exposure

Safety and Health Information Bulletin

SHIB 03-08-2018
DHHS (NIOSH) Publication No. 2018-124

Introduction

Millions of workers are exposed to noise in the workplace every day and when uncontrolled, noise exposure may cause permanent hearing loss. Research demonstrates exposure to certain chemicals, called ototoxicants, may cause hearing loss or balance problems, regardless of noise exposure. Substances including certain pesticides, solvents, and pharmaceuticals that contain ototoxicants can negatively affect how the ear functions, causing hearing loss, and/or affect balance.

Source/Copyright: OSHA

The risk of hearing loss is increased when workers are exposed to these chemicals while working around elevated noise levels. This combination often results in hearing loss that can be temporary or permanent, depending on the level of noise, the dose of the chemical, and the duration of the exposure. This hearing impairment affects many occupations and industries, from machinists to firefighters.

Effects on Hearing

Harmful exposure to ototoxicants may occur through inhalation, ingestion, or skin absorption. Health effects caused by ototoxic chemicals vary based on exposure frequency, intensity, duration, workplace exposure to other hazards, and individual factors such as age. Effects may be temporary or permanent, can affect hearing sensitivity and result in a standard threshold shift. Since chemicals can affect central portions of the auditory system (e.g., nerves or nuclei in the central nervous system, the pathways to the brain or in the brain itself), not only do sounds need to be louder to be detected, but also they lose clarity. Specifically, speech discrimination dysfunction, the ability to hear voices separately from background noise, may occur and involve:

- Compressed loudness: sound distortion.
- Frequency resolution: the inability to differentiate two sounds with similar frequency.
- Temporal resolution: the inability to detect time gaps between sounds.
- Spatial resolution: the inability to localize sound.

Speech discrimination dysfunction can also make working in noisy environments difficult and increase the risk of workplace injuries due to an inability to hear co-workers, environmental sounds and warning signals.

There is growing concern among occupational health and safety professionals that ototoxicant-induced hearing loss may go unrecognized since the measure for hearing loss does not indicate the cause. For example, audiometric tests are powerful tools that show hearing impairments (i.e., threshold shifts); however, they do not differentiate between noise and ototoxic causes.

Combined exposure: health effects below the noise PEL

OSHA standards require employers to maintain exposure to the specific substance at or below the PEL. However, synergistic effects from the combined ototoxicant and noise exposure could result in hearing loss when exposures are below the PEL.

Hearing loss can be even greater with exposure to both ototoxic chemicals and noise than exposure to either noise or the ototoxic chemical alone.[1] Many ototoxic substances have a greater-than-additive (e.g., synergistic) effect on hearing loss with noise exposure and in particular with impulse noise.[2] Several studies have suggested that some ototoxic chemicals, such as certain solvents, might exacerbate noise-induced hearing loss even though the noise level is below OSHA's Permissible Exposure Limit (PEL).[3]

What are ototoxic chemicals and substances that contain ototoxicants?

Ototoxic chemicals are classified as neurotoxicants, cochleotoxicants, or vestibulotoxicants based on the part of the ear they damage, and they can reach the inner ear through the blood stream and cause injury to inner parts of the ear and connected neural pathways.[4] Neurotoxicants are ototoxic when they damage the nerve fibers that interfere with hearing and balance. Cochleotoxicants mainly affect the cochlear hair cells, which are the sensory receptors, and can impair the ability to hear. Vestibulotoxicants affect the hair cells on the spatial orientation and balance organs.[5] The research on ototoxicants and their interactions with noise is limited. The dose-response, lowest observed effect level (LOEL) and no observed effect level (NOEL) have been identified in animal experiments for only a few substances.[6]

The following table includes examples of ototoxic chemicals grouped by substance class.[7]

Substance Class	Chemicals
Pharmaceuticals ***Ototoxicity at therapeutic doses is limited***	Aminoglycosidic antibiotics (e.g. streptomycin, gentamycin) and some other antibiotics (e.g. tetracyclines), Loop diuretics* (e.g. furosemide, ethacrynic acid) Certain analgesics* and antipyretics* (salicylates, quinine, chloroquine) Certain antineoplastic agents (e.g. cisplatin, carboplatin, bleomycin).
Solvents	Carbon disulfide, n-hexane, toluene, p-xylene, ethylbenzene, n-propylbenzene, styrene and methylstyrene, trichloroethylene.
Asphyxiants	Carbon monoxide, hydrogen cyanide and its salts, tobacco smoke
Nitriles	3-Butenenitrile, cis-2-pentenenitrile, acrylonitrile, cis-crotononitrile, 3,3'-iminodipropionitrile.
Metals and Compounds	Mercury compounds, germanium dioxide, organic tin compounds, lead.

Table: Selected Ototoxicants

The table does not identify all known toxicants and, in addition, there is limited evidence that supports the ototoxicity of other chemicals including cadmium, arsenic, bromates, halogenated hydrocarbons, insecticides, alkylic compounds, and manganese.

The exposure threshold for ototoxicity varies for each chemical based on its compound family, properties, exposure route, exposure concentration and duration, synergy with noise, and noise exposure, along with an individual's risk factors.

Which industries are more likely to have ototoxicants?

Industries that use potential ototoxicants include manufacturing, mining, utilities, construction, and agriculture. Manufacturing industry subsectors may include:

- Fabricated metal
- Machinery
- Leather and Allied Product
- Textile and Apparel
- Petroleum
- Paper
- Chemical (including Paint)
- Furniture and Related Product
- Transportation Equipment (e.g. Ship and Boat Building)
- Electrical Equipment, Appliance and Component (e.g., Batteries)
- Solar Cell

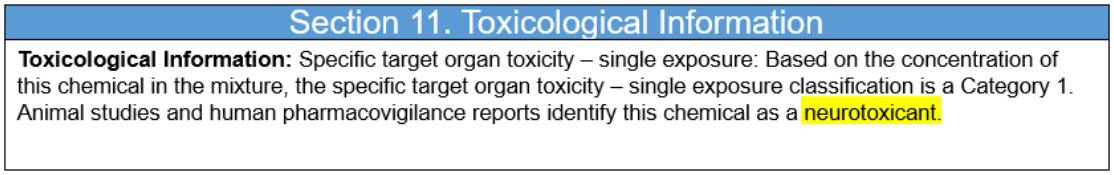
Occupational activities that often have high noise exposure and could add synergistic effects when combined with ototoxicant exposure (i.e., occurring in the above industries) may include:

- Printing
- Painting
- Construction
- Manufacturing occupations in the subsectors listed above
- Firefighting
- Weapons firing
- Pesticide spraying

When specific ototoxicity information is not available, information on the chemical's general toxicity, nephrotoxicity, and neurotoxicity may provide clues about the potential ototoxicity. Most chemicals that are known to affect the auditory system are also neurotoxic and/or nephrotoxic. Information on whether a chemical produces reactive free radicals could also give some clues about the agent's potential ototoxicity.

Prevention

The first step in preventing exposure to ototoxicants is to know if they are in the workplace. One way to identify ototoxicants in the workplace is by reviewing Safety Data Sheets (SDS) for ototoxic substances and/or chemicals, and ototoxic health hazards associated with ingredients in the product. For example, Figure 1 shows an SDS where ototoxicants may be in a product.


Section 11. Toxicological Information

Toxicological Information: Specific target organ toxicity – single exposure: Based on the concentration of this chemical in the mixture, the specific target organ toxicity – single exposure classification is a Category 1. Animal studies and human pharmacovigilance reports identify this chemical as a neurotoxicant.

Figure 1: Check the SDS.

Source/Copyright: OSHA

Employers must provide health and safety information as well as training to workers exposed to hazardous materials, including ototoxic chemicals (see OSHA's hazard communication standard at 29 CFR 1910.1200). The training must be in a language and vocabulary that the worker understands. Additionally, complaints from workers about hearing loss should include investigating SDSs for ototoxicants.

Controlling Exposure

Replacing a hazardous chemical with a less toxic chemical is an effective way to reduce exposure when ototoxicants are identified in the workplace.

If eliminating ototoxicants from the workplace is not possible, using engineering controls, such as isolation and enclosures to control exposure to ototoxicants and noise, may reduce risk for adverse health effects. Ventilation is also a recommended control method for ototoxicants.

Some administrative controls to consider include eliminating unnecessary tasks that cause noise or ototoxicant exposure, or operating noisy equipment when workers are not near.

Personal Protective Equipment (PPE)

Employers must assess and determine the appropriate PPE according to the general requirements in 29 CFR 1910.132, the respiratory protection requirements in 29 CFR 1910.134, and the hand protection requirements in 29 CFR 1910.138.

Since many ototoxic substances can be absorbed through the skin, chemical-protective gloves, arm sleeves, aprons and other appropriate clothing can assist in reducing dermal exposure.

OSHA's occupational noise exposure standard at 29 CFR 1910.95 only requires audiometric testing at the noise action level (i.e., an 85-decibel 8-hour time-weighted average). However, wearing hearing protection and using audiometric testing to detect early signs of hearing loss, even in workers exposed below the action level and ototoxic chemicals below the PEL, may prevent hearing loss from their synergistic effects.

Information on Hearing Loss Prevention programs and their effectiveness is available online from the National Institute for Occupational Safety and Health (NIOSH) at www.cdc.gov/niosh/topics/noise/preventhearingloss/hearlosspreventprograms.html.

Additional Information

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.

- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

Contact OSHA

Under the Act, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321- OSHA (6742), TTY 1-877-889-5627.

Contact NIOSH

To receive documents or more information about occupational safety and health topics, please contact NIOSH at 1-800-CDC-INFO (1-800-232-4636), TTY 1-888-232-6348, email: cdcinfo@cdc.gov or visit the NIOSH website at: www.cdc.gov/niosh.

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[1] European Agency for Safety and Health at Work. Combined Exposure to Noise and Ototoxic Substances. 2009. p 27.

[2] Campo P., Venet T., Thomas A., Cour C., Brochard C., Cosnier F. Neuropharmacological and cochleotoxic effects of styrene. Consequences on noise exposures. Neurotoxicol Teratol. 2014 Jul-Aug; 44:113-20.

[3] Occupational Safety and Health Administration. OSHA Technical Manual. Appendix D-3.

[4] European Agency for Safety and Health at Work. Combined Exposure to Noise and Ototoxic Substances. 2009. p 9.

[5] Johnson, A.C. and T.C. Morata. Occupational exposure to chemicals and hearing impairment, in Arbete och Hälsa, The Nordic Expert Group, Editor. 2010: Gothenburg. p. 1. Available at http://hdl.handle.net/2077/23240

[6] European Agency for Safety and Health at Work. Combined Exposure to Noise and Ototoxic Substances. 2009. p 17.

[7] Morata T.C., Dunn D.E., Sieber W.K. Occupational exposure to noise and ototoxic organic solvents. Archives of Environmental Health, 1994; 49(5):359-365.

ATTACHMENT 5

OSHA Fact Sheet: Lightning Safety When Working Outdoors

FactSheet

Lightning Safety When Working Outdoors

Lightning strikes can severely injure or kill workers whose jobs involve working outdoors. Lightning is often overlooked as an occupational hazard, but employers need awareness about lightning hazards to ensure their workers' safety. This fact sheet provides employers and workers at outdoor worksites with lightning safety recommendations from the Occupational Safety and Health Administration (OSHA) and the National Oceanic and Atmospheric Administration (NOAA).

Introduction

Lightning is a dangerous natural force. Annually in the United States, cloud-to-ground lightning occurs 20 to 25 million times and over 300 people are struck by lightning. During the past 30 years, about 50 people, on average, have been killed by lightning strikes every year, and many more suffer permanent disabilities.

Precautions should be taken to prevent worker exposure to lightning. Employers should recognize lightning as an occupational hazard. Supervisors and workers at outdoor worksites should take lightning safety seriously.

Workers whose jobs involve working outdoors in open spaces, on or near tall objects, or near explosives or conductive materials (e.g., metal) have significant exposure to lightning risks. Worker activities at higher risk for lightning hazards include:

- Logging
- Explosives handling or storage
- Heavy equipment operation
- Roofing
- Construction (e.g., scaffolding)
- Building maintenance
- Power utility field repair
- Steel erection/telecommunications
- Farming and field labor
- Plumbing and pipe fitting
- Lawn services/landscaping
- Airport ground personnel operations
- Pool and beach lifeguarding

Photo: NOAA

Figure 1: Lightning strikes tall tree.

Reducing Lightning Hazards When Working Outdoors

Employers, supervisors, and workers should understand lightning risks, characteristics, and precautions to minimize workplace hazards. Lightning is unpredictable and can strike outside the heaviest rainfall areas or even up to 10 miles from any rainfall.

Many lightning victims are caught outside during a storm because they did not act promptly to get to a safe place, **or they go back outside too soon after a storm has passed**. If signs of approaching thunderstorms occur, workers should not begin any task they cannot quickly stop. Proper planning and safe practices can easily increase lightning safety when working outdoors.

When thunder roars, go indoors!

If you hear thunder, even a distant rumble, get to a safe place immediately.

Thunderstorms always include lightning. Any thunder you hear is caused by lightning!

NOAA advises that nowhere outside is safe when thunderstorms are in your area.

OSHA and NOAA recommend that employers and supervisors follow these lightning safety best practices for workers whose jobs involve working outdoors:

Check NOAA Weather Reports: Prior to beginning any outdoor work, employers and supervisors should check NOAA weather reports (weather.gov) and radio forecasts for all weather hazards. OSHA recommends that employers consider rescheduling jobs to avoid workers being caught outside in hazardous weather conditions. When working outdoors, supervisors and workers should continuously monitor weather conditions. Watch for darkening clouds and increasing wind speeds, which can indicate developing thunderstorms. Pay close attention to local television, radio, and Internet weather reports, forecasts, and emergency notifications regarding thunderstorm activity and severe weather.

Photo: NOAA

Figure 2: Lightning strikes a communications tower.

Seek Shelter in Buildings: Employers and supervisors should know and tell workers which buildings to go to after hearing thunder or seeing lightning. NOAA recommends seeking out fully enclosed buildings with electrical wiring and plumbing. Remain in the shelter for at least **30 minutes** after hearing the last sound of thunder.

Vehicles as Shelter: If safe building structures are not accessible, employers should guide workers to hard-topped metal vehicles with rolled up windows. Remain in the vehicle for at least **30 minutes** after hearing the last sound of thunder.

Phone Safety: After hearing thunder, do not use corded phones, except in an emergency. Cell phones and cordless phones may be used safely.

Emergency Action Plan

Employers should have a written Emergency Action Plan (EAP), as outlined in 29 CFR 1910.38 or 29 CFR 1926.35. The EAP should include a written lightning safety protocol for outdoor workers. This lightning safety protocol should:

- Inform supervisors and workers to take action after hearing thunder, seeing lightning, or perceiving any other warning signs of approaching thunderstorms.
- Indicate how workers are notified about lightning safety warnings.
- Identify locations and requirements for safe shelters.
- Indicate response times necessary for all workers to reach safe shelters.
- Specify approaches for determining when to suspend outdoor work activities, and when to resume outdoor work activities.
- Account for the time required to evacuate customers and members of the public, and the time needed for workers to reach safety.

Employers should also post information about lightning safety at outdoor worksites. All employees should be trained on how to follow the EAP, including the lightning safety procedures.

Photo: NOAA

Figure 3: Cranes are especially vulnerable to lightning.

What is lightning?

Lightning is a giant spark of electricity in the atmosphere between clouds or between a cloud and the ground.

Lightning can occur:

- Between the cloud and the ground (cloud-to-ground lightning)
- Within and between thunderstorm clouds (intra- and inter-cloud lightning)

For more information, see: www.nssl.noaa.gov/education/svrwx101/lightning/faq

Lightning Safety Training

Employers should adequately train all workers on lightning safety. Training should be provided for each outdoor worksite, so that supervisors and workers know in advance where a worksite's safe shelters are and the time it takes to reach them. Employers should train supervisors and workers to provide lightning safety warnings in sufficient time for everyone to reach a worksite's safe shelters and take other appropriate precautions.

Lightning Warning Systems

An employer's EAP may include lightning warning or detection systems, which can provide advance warning of lightning hazards. However, no systems can detect the "first strike," detect all lightning, or predict lightning strikes. NOAA recommends that employers first rely on NOAA weather reports, including NOAA Weather Radio All Hazards: www.nws.noaa.gov/nwr.

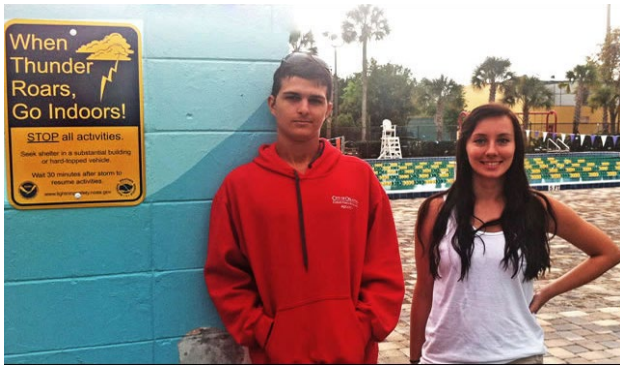

Photo: NOAA

Figure 4: Preparedness reduces lightning risks.

(For NOAA toolkits for organizations and large venues see: www.lightningsafety.noaa.gov/toolkits.shtml)

Commercial lightning detection and notification services are available to monitor for lightning activity. These notification services can send alerts when lightning activity develops or moves to within a certain range of a work site. In addition, these commercial systems can provide mapped locations of lightning strikes from an approaching storm. However, these systems cannot predict the first lightning strike. Consequently, it is important to watch the sky for storms developing overhead or nearby and get to a safe place prior to the first lightning strike.

Portable and hand-held lightning detectors function by detecting the electromagnetic signal from a nearby lightning strike and then processing the signal to estimate the distance to the lightning strike. These devices typically do not detect all strikes, cannot predict the first strike, cannot provide the location of a strike, and are less accurate than the commercial detection and notification systems. In some cases, simply listening for thunder or watching the sky may be a better indication of a developing or nearby storm.

For situations which require advance notice of thunderstorms, NOAA recommends monitoring forecasts and radar observations from either commercial weather services or NOAA to stay informed of changing weather conditions.

If Caught Outside in a Thunderstorm

If you find yourself caught outside during a thunderstorm, there may be nothing you can do to prevent being struck by lightning. There simply is no safe place outside in a thunderstorm. This is why it is very important to get to a safe place at the first signs of a thunderstorm. If you are caught outside follow NOAA's recommendations to decrease the risk of being struck.

- Lightning is likely to strike the tallest objects in a given area—you should not be the tallest object.
- Avoid isolated tall trees, hilltops, utility poles, cell phone towers, cranes, large equipment, ladders, scaffolding, or rooftops.
- Avoid open areas, such as fields. Never lie flat on the ground.
- Retreat to dense areas of smaller trees that are surrounded by larger trees, or retreat to low-lying areas (e.g., valleys, ditches) but watch for flooding.
- Avoid water, and immediately get out of and away from bodies of water (e.g., pools, lakes).

Water does not attract lightning, but it is an excellent conductor of electricity. For boating safety see NOAA PA 200252.

- Avoid wiring, plumbing, and fencing. Lightning can travel long distances through metal, which is an excellent conductor of electricity. Stay away from all metal objects, equipment, and surfaces that can conduct electricity.
- Do not shelter in sheds, pavilions, tents, or covered porches as they do not provide adequate protection from lightning.
- Seek fully-enclosed, substantial buildings with wiring and plumbing. In modern buildings, the *interior* wiring and plumbing will act as an earth ground. A building is a safe shelter as long as you are not in contact with anything that can conduct electricity (e.g., electrical equipment or cords, plumbing fixtures, corded phones). Do not lean against concrete walls or floors (which may have metal bars inside).

OSHA Standards

Under the General Duty Clause, Section 5(a)(1) of the *Occupational Safety and Health Act of 1970* (OSH Act), employers are required to provide their employees with a place of employment that "is free from recognizable hazards that are causing or likely to cause death or serious harm to employees." The courts have interpreted OSHA's general duty clause to mean that an employer has a legal obligation to provide a workplace free of conditions or activities that either the employer or industry recognizes as hazardous and that cause, or are likely to cause, death or serious physical harm to employees when there is a feasible method to abate the hazard. This includes lightning hazards that can cause death or serious bodily harm.

During storms or high winds, OSHA prohibits:

- work on or from scaffolds (29 CFR 1926.451(f)(12));
- crane hoists (29 CFR 1926.1431(k)(8)); and
- work on top of walls (29 CFR 1926.854(c)).

In these situations, scaffold work may continue only if a qualified person determines it is safe and personal fall protection or wind screens are provided. Crane hoists may continue only if a qualified person determines it is safe.

Helpful Resources

- NOAA Lightning Safety on the Job, www.lightningsafety.noaa.gov/job.shtml
- National Fire Protection Association (NFPA):
- *NFPA 780: Standard for the Installation of Lightning Protection Systems*, 2014 Edition, www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=780
- National Lightning Safety Institute, lightningsafety.com
- National Aeronautics and Space Administration (NASA), Global Hydrology Resource Center, Lightning and Atmospheric Electricity Research, thunder.msfc.nasa.gov
- Transportation Research Board of the National Academies,a*Protecting Airport Personnel from*
- *Lightning Strikes,* onlinepubs.trb.org/onlinepubs/acrp/acrp_iop_004.pdf

Contact NOAA

For information on lightning safety, or to obtain data, educational and outreach materials, and posters, visit NOAA's lightning safety website: www.lightningsafety.noaa.gov or the wrn program at noaa.gov/wrn. Contact NOAA at wrn.feedback@noaa.gov. Examples of data available from NOAA are provided below.

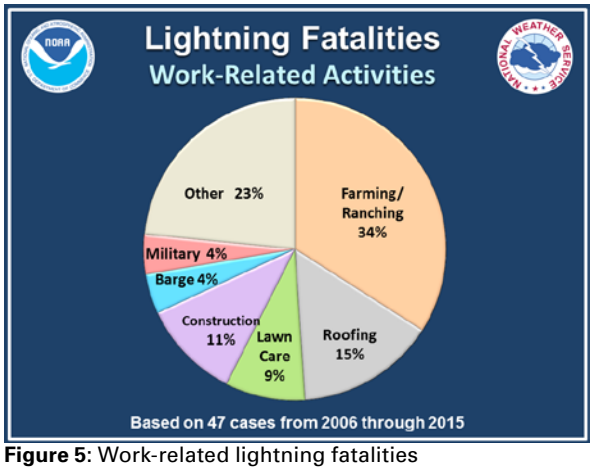

Figure 5: Work-related lightning fatalities

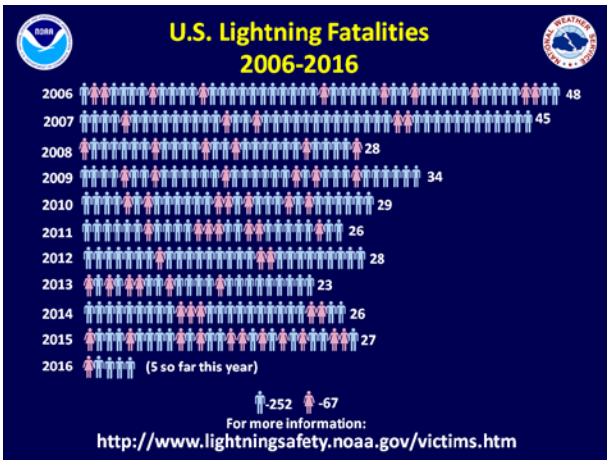

Figure 6: Annual lightning fatalities

Contact OSHA

For more information, to report an emergency, fatality, inpatient hospitalization, amputation, or loss of an eye, or to file a confidential compliant, or to request OSHA's free On-site Consultation Program services for small and medium-sized businesses, contact your nearest OSHA office, visit www.osha.gov, or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For more information, see OSHA's Workers page.

U.S. Department of Labor

Occupational Safety and Health Administration

OSHA - DTSEM FS-3863 05/2016

ATTACHMENT 6

OSHA Fact Sheet: Protecting Workers from the Effects of Heat

OSHA® FactSheet

Protecting Workers from the Effects of Heat

At times, workers may be required to work in hot environments for long periods. When the human body is unable to maintain a normal temperature, heat illnesses can occur and may result in death. It is also important to consider that hot work environments may exist indoors. This fact sheet provides information to employers on measures they should take to prevent worker illnesses and death caused by heat stress.

What is Heat Illness?

The following are illnesses that may result from exposure to heat in the workplace.

Heat Stroke is the most serious heat-related health problem. Heat stroke occurs when the body's temperature regulating system fails and body temperature rises to critical levels (greater than 104°F). ***This is a medical emergency that may result in death!*** The signs of heat stroke are confusion, loss of consciousness, and seizures. Workers experiencing heat stroke have a very high body temperature and may stop sweating. If a worker shows signs of possible heat stroke, ***get medical help immediately***, and call 911. Until medical help arrives, move the worker to a shady, cool area and remove as much clothing as possible. Wet the worker with cool water and circulate the air to speed cooling. Place cold wet cloths, wet towels or ice all over the body or soak the worker's clothing with cold water.

Occupational Factors that May Contribute to Heat Illness

- High temperature and humidity
- Low fluid consumption
- Direct sun exposure (with no shade) or extreme heat
- Limited air movement (no breeze or wind)
- Physical exertion
- Use of bulky protective clothing and equipment

Heat Exhaustion is the next most serious heat-related health problem. The signs and symptoms of heat exhaustion are headache, nausea, dizziness, weakness, irritability, confusion, thirst, heavy sweating and a body temperature greater than 100.4°F. Workers with heat exhaustion should be removed from the hot area and given liquids to drink. Cool the worker with cold compresses to the head, neck, and face or have the worker wash his or her head, face and neck with cold water. Encourage frequent sips of cool water. Workers with signs or symptoms of heat exhaustion should be taken to a clinic or emergency room for medical evaluation and treatment. Make sure that someone stays with the worker until help arrives. If symptoms worsen, call 911 and get help immediately.

Heat Cramps are muscle pains usually caused by the loss of body salts and fluid during sweating. Workers with heat cramps should replace fluid loss by drinking water and/or carbohydrate-electrolyte replacement liquids (e.g., sports drinks) every 15 to 20 minutes.

Heat Rash is the most common problem in hot work environments. Heat rash is caused by sweating and looks like a red cluster of pimples or small blisters. Heat rash may appear on the neck, upper chest, groin, under the breasts and elbow creases. The best treatment for heat rash is to provide a cooler, less humid work environment. The rash area should be kept dry. Powder may be applied to increase comfort. Ointments and creams should ***not*** be used on a heat rash. Anything that makes the skin warm or moist may make the rash worse.

Prevention Made Simple: Program Elements

Heat Illness Prevention Program key elements include:

- A Person Designated to Oversee the Heat Illness Prevention Program
- Hazard Identification
- Water. Rest. Shade Message
- Acclimatization
- Modified Work Schedules
- Training
- Monitoring for Signs and Symptoms
- Emergency Planning and Response

Designate a Person to Oversee the Heat Stress Program

Identify someone trained in the hazards, physiological responses to heat, and controls. This person can develop, implement and manage the program.

Hazard Identification

Hazard identification involves recognizing heat hazards and the risk of heat illness due to high temperature, humidity, sun and other thermal exposures, work demands, clothing or PPE and personal risk factors.

Identification tools include: OSHA's Heat Smartphone App; a Wet Bulb Globe Thermometer (WBGT) which is a measure of heat stress in direct sunlight that takes into account temperature, humidity, wind speed, sun and cloud cover; and the National Weather Service Heat Index. Exposure to full sun can increase heat index values up to 15°F.

Water.Rest.Shade

Ensure that cool drinking water is available and easily accessible. (Note: Certain beverages, such as caffeine and alcohol can lead to dehydration.)

Encourage workers to drink a liter of water over one hour, which is about one cup every fifteen minutes.

Provide or ensure that fully shaded or air-conditioned areas are available for resting and cooling down.

Acclimatization

Acclimatization is a physical change that allows the body to build tolerance to working in the heat. It occurs by gradually increasing workloads and exposure and taking frequent breaks for water and rest in the shade. Full acclimatization may take up to 14 days or longer depending on factors relating to the individual, such as increased risk of heat illness due to certain medications or medical conditions, or the environment.

New workers and those returning from a prolonged absence should begin with 20% of the workload on the first day, increasing incrementally by no more than 20% each subsequent day.

During a rapid change leading to excessively hot weather or conditions such as a heat wave, even experienced workers should begin on the first day of work in excessive heat with 50% of the normal workload and time spent in the hot environment, 60% on the second day, 80% on day three, and 100% on the fourth day.

Modified Work Schedules

Altering work schedules may reduce workers' exposure to heat. For instance:

- Reschedule all non-essential outdoor work for days with a reduced heat index.
- Schedule the more physically demanding work during the cooler times of day;
- Schedule less physically demanding work during warmer times of the day;
- Rotate workers and split shifts, and/or add extra workers.
- Work/Rest cycles, using established industry guidelines.
- Stop work if essential control methods are inadequate or unavailable when the risk of heat illness is very high.

Keep in mind that very early starting times may result in increased fatigue. Also, early morning hours tend to have higher humidity levels.

Training

Provide training in a language and manner workers understand, including information on health effects of heat, the symptoms of heat illness, how and when to respond to symptoms, and how to prevent heat illness.

Monitoring for Heat Illness Symptoms

Establish a system to monitor and report the signs and symptoms listed on the previous page to improve early detection and action. Using a buddy system will assist supervisors when watching for signs of heat illness.

Emergency Planning and Response

Have an emergency plan in place and communicate it to supervisors and workers. Emergency plan considerations include:

- What to do when someone is showing signs of heat illness. This can make the difference between life and death.
- How to contact emergency help.
- How long it will take for emergency help to arrive and training workers on appropriate first-aid measures until help arrives.
- Consider seeking advice from a healthcare professional in preparing a plan.

Engineering Controls Specific to Indoor Workplaces

Indoor workplaces may be cooled by using air conditioning or increased ventilation, assuming that cooler air is available from the outside. Other methods to reduce indoor temperature include: providing reflective shields to redirect radiant heat, insulating hot surfaces, and decreasing water vapor pressure, e.g., by sealing steam leaks and keeping floors dry. The use of fans to increase the air speed over the worker will improve heat exchange between the skin surface and the air, unless the air temperature is higher than the skin temperature. However, increasing air speeds above 300 ft. per min. may actually have a warming effect. Industrial hygiene personnel can assess the degree of heat stress caused by the work environment and make recommendations for reducing heat exposure.

Additional information

For more information on this and other issues affecting workers or heat stress, visit: www.osha.gov/heat; www.cdc.gov/niosh/topics/heatstress; and www.noaa.gov/features/earthobs_0508/heat.html.

Workers have the right to working conditions that do not pose a risk of serious harm, to receive information and training about workplace hazards and how to prevent them, and to file a complaint with OSHA to inspect their workplace without fear of retaliation.

For more information about workers' rights, see OSHA's workers page at www.osha.gov/workers.html.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

U.S. Department of Labor

DTSEM FS-3743 08/2014

ATTACHMENT 7

OSHA Quick Card: Protecting Workers from Heat Stress

OSHA® QUICK CARD™

Protecting Workers from Heat Stress

Heat Illness

Exposure to heat can cause illness and death. The most serious heat illness is heat stroke. Other heat illnesses, such as heat exhaustion, heat cramps and heat rash, should also be avoided.

There are precautions that can be taken any time temperatures are high and the job involves physical work.

Risk Factors for Heat Illness

- High temperature and humidity, direct sun exposure, no breeze or wind
- Heavy physical labor
- No recent exposure to hot workplaces
- Low liquid intake
- Waterproof clothing

Symptoms of Heat Exhaustion

- Headache, dizziness, or fainting
- Weakness and wet skin
- Irritability or confusion
- Thirst, nausea, or vomiting

Symptoms of Heat Stroke

- May be confused, unable to think clearly, pass out, collapse, or have seizures (fits)
- May stop sweating

To Prevent Heat Illness:

- Establish a complete heat illness prevention program.
- Provide training about the hazards leading to heat stress and how to prevent them.
- Provide a lot of cool water to workers close to the work area. At least one pint of water per hour is needed.

U.S. Department of Labor

For more information:

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

OSHA 3154-06R 2017

OSHA® QUICK CARD™

- Modify work schedules and arrange frequent rest periods with water breaks in shaded or air-conditioned areas.
- Gradually increase workloads and allow more frequent breaks for workers new to the heat or those that have been away from work to adapt to working in the heat (acclimatization).
- Designate a responsible person to monitor conditions and protect workers who are at risk of heat stress.
- Consider protective clothing that provides cooling.

How to Protect Workers

- Know signs/symptoms of heat illnesses; monitor yourself; use a buddy system.
- Block out direct sun and other heat sources.
- Drink plenty of fluids. Drink often and BEFORE you are thirsty. Drink water every 15 minutes.
- Avoid beverages containing alcohol or caffeine.
- Wear lightweight, light colored, loose-fitting clothes.

What to Do When a Worker is Ill from the Heat

- Call a supervisor for help. If the supervisor is not available, call 911.
- Have someone stay with the worker until help arrives.
- Move the worker to a cooler/shaded area.
- Remove outer clothing.
- Fan and mist the worker with water; apply ice (ice bags or ice towels).
- Provide cool drinking water, if able to drink.

IF THE WORKER IS NOT ALERT or seems confused, this may be a heat stroke. CALL 911 IMMEDIATELY and apply ice as soon as possible.

U.S. Department of Labor

For more information:

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

ATTACHMENT 8

OSHA Quick Card: Protecting Workers from Cold Stress

OSHA® QUICK CARD™

Protecting Workers from Cold Stress

Cold temperatures and increased wind speed (wind chill) cause heat to leave the body more quickly, putting workers at risk of cold stress. Anyone working in the cold may be at risk, e.g., workers in freezers, outdoor agriculture and construction.

Common Types of Cold Stress

Hypothermia

- Normal body temperature (98.6°F) drops to 95°F or less.
- **Mild Symptoms:** alert but shivering.
- **Moderate to Severe Symptoms:** shivering stops; confusion; slurred speech; heart rate/breathing slow; loss of consciousness; death.

Frostbite

- Body tissues freeze, e.g., hands and feet. Can occur at temperatures above freezing, due to wind chill. May result in amputation.
- **Symptoms**: numbness, reddened skin develops gray/white patches, feels firm/hard, and may blister.

Trench Foot (also known as Immersion Foot)

- Non-freezing injury to the foot, caused by lengthy exposure to wet and cold environment. Can occur at air temperature as high as 60°F, if feet are constantly wet.
- **Symptoms**: redness, swelling, numbness, and blisters.

Risk Factors

- Dressing improperly, wet clothing/skin, and exhaustion.

For Prevention, Your Employer Should:

- Train you on cold stress hazards and prevention.
- Provide engineering controls, e.g., radiant heaters.
- Gradually introduce workers to the cold; monitor workers; schedule breaks in warm areas.

For more information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov (800) 321-OSHA (6742)

OSHA 3156-02R 2014

WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Preventing Cold-related Illness, Injury, and Death among Workers

Summary

Workers, both indoors and outdoors, in services, transportation, agriculture, construction, and other industries may be exposed to environmental cold stress that can lead to thermal discomfort and in some cases even severe injuries, illnesses, or death. The National Institute for Occupational Safety and Health (NIOSH) recommends that employers implement a cold-related illness and injury prevention program that includes preventive measures such as using engineering controls, establishing work/rest schedules, training workers about the hazards of working in cold environments, and providing appropriate cold-weather gear.

Description of Exposure

Workers who work in cold environments may be at risk of cold stress. Exposure to cold can be an uncomfortable and potentially dangerous situation. Health emergencies can occur in people who work outdoors or in an area that is purposefully kept cold, poorly insulated, or without heat. People who have previously experienced frostbite, sedentary workers, and those with poor circulation may be especially susceptible. For indoor workers, work in cold, damp conditions can be uncomfortable and may lead to declining work performance (i.e., a decline in cognitive function and dexterity) or result in cold-related illness or injury. Cold-related conditions can also worsen musculoskeletal injuries and vascular disorders. For outdoor workers, what constitutes cold stress can vary across different areas of the country. In regions where workers are unaccustomed to winter weather, near freezing temperatures are considered factors for cold stress. Whenever outdoor temperatures drop substantially and wind speed increases, heat leaves the body more rapidly. According to the American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Values (TLV®), workers should be protected from exposure to cold so that the deep core temperature does not fall below 96.8°F (36°C) and to prevent frostbite to body extremities [ACGIH 2019]. Serious health problems can occur when the body is unable to stay warm enough.

Photo by MarianVejcik/Getty Images

Cold-related Illnesses and Injuries

Cold-related illnesses and injuries include chilblains, trench foot, frostbite, and hypothermia.

Chilblains. Chilblains are the painful inflammation of small blood vessels in the skin that occur in response to repeated exposure to cold but nonfreezing temperatures. Small blood vessels in the skin may become permanently damaged by cold temperatures, resulting in redness and itching during additional exposures. Symptoms of chilblains include redness, itching, possible blistering, inflammation, and possible ulceration in severe cases.

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

Trench Foot. Trench foot is an injury of the feet after prolonged exposure to wet and cold-related conditions. Trench foot occurs because wet feet lose heat faster than dry feet. To prevent heat loss, the body constricts blood vessels in the feet, and then the skin tissue begins to die. Symptoms of trench foot include reddening of the skin, numbness, leg cramps, swelling, tingling pain, blisters or ulcers, bleeding under the skin, and gangrene (e.g., foot turns purple, blue, or gray).

Frostbite. Frostbite is an injury caused by freezing of the skin and deeper tissues, resulting in the loss of feeling and color in the affected areas. Frostbite can permanently damage body tissues, and severe cases can lead to amputation. Examples of risk factors for frostbite include contact with metal or water, dehydration, diabetes, smoking, alcohol abuse, sedating or judgment impairing medications, and prior history of frostbite. Symptoms of frostbite include numbness; tingling or stinging; aching; and bluish or pale, waxy skin. During treatment of frostbite and trench foot, avoid rubbing or putting pressure on affected areas, since that can damage tissue.

Hypothermia. When exposed to cold temperatures, the body loses heat faster than it can be produced. Prolonged exposure to cold causes internal body temperature to drop, resulting in a condition called hypothermia. Hypothermia affects brain function, making the victim unable to think clearly or move well (i.e., they may be unable to protect themselves from hazards, or experience slips, trips, and falls). This makes hypothermia particularly dangerous because a person may not recognize the symptoms and will be unable to make life-preserving decisions. Symptoms of hypothermia can depend on how long a person has been exposed to cold temperatures and individual variability.

Hypothermia Symptoms and First Aid

Early symptoms include shivering, fatigue, loss of coordination, confusion, and/or disorientation.

Late symptoms include no shivering, blue skin, dilated pupils, slowed pulse and breathing, and/or loss of consciousness.

If hypothermia is suspected, medical assistance should be requested immediately (e.g., call 911). Begin first aid by:

1. moving the worker to a warm room or vehicle,
2. removing wet clothing,
3. covering their body with loose, dry blankets, clothing, or towels (may use skin-to-skin contact or warm bottles or hot packs in armpits, sides of chest, and groin to increase body's temperature), and
4. providing warm, non-alcoholic beverages if the worker is conscious.

If the worker has no pulse, cardiopulmonary resuscitation (CPR) should be provided and continued during the warming attempts, until the person responds or medical aid becomes available. Chest compressions should not be performed for patients who manifest an organized rhythm on a cardiac monitor (e.g., automated external defibrillator [AED]), even if they have no palpable pulses and no other signs of life. The worker should be handled very gently and kept horizontal, because when cold, the heart is prone to ventricular fibrillation with any disturbance. Severely hypothermic patients have been known to survive neurologically intact after long periods (over an hour) in a state of "suspended animation" [State of Alaska DHSS 2014].

Photo by ilkercelik/Getty Images

Case Reports

Indoor Environment: Airline Catering Facility

In an airline catering facility cold room (approximately 40°F), meals were assembled at workstations in shifts lasting 3–8 hours [Ceballos et al. 2015; NIOSH 2014]. Because preparations sometimes required fine manual dexterity (e.g., thinly slicing fish, decorating with small garnishes), the workers preferred wearing thin gloves instead of thicker, better insulated gloves. The frozen food they handled caused their hands to become cold and numb. Drafts inside the cold room made some areas feel colder than others, and air velocities exceeded the recommended guidelines of 200 feet per minute (FPM) [ACGIH 2019]. In addition, the workers felt that their breaks were not long enough to warm up, or to change out of wet or sweat-dampened clothing. An evaluation of the cold room concluded that thermal comfort concerns perceived by workers might have resulted from workstation air drafts, insufficient use of personal protective equipment (e.g., better insulated gloves) due to dexterity concerns, work practices, and lack of knowledge about good health and safety practices. In an evaluation of a second airline catering facility where the temperature was approximately 40°F, workers reported that they

felt discomfort working in cold temperatures, particularly in the freezer or coolers [NIOSH 2015]. The reported findings suggest that language was a barrier to effective training and communication regarding workplace safety and health because employees came from 18 countries.

Outdoor Environment: Long Haul Driving Along Highway

In the winter of 2009, a 56-year-old male truck driver went to the emergency room seeking care [Alaska Trauma Registry]. He had come to Alaska after a long haul drive through Canada. Along his route, he had stopped to change a fuel filter. He accidentally splashed diesel fuel on his gloves, which froze to his hands as he worked outside along the highway. After arriving at his destination, he had to spend a night at the hospital receiving treatment for his frostbitten hands.

Outdoor Environment: Sheep Ranch

At 3:00 p.m., a 58-year-old woman (who was wearing tennis shoes, blue jeans, sweater, jacket, and gloves) and her husband left their sheep ranch headquarters to round up their animals and bring them in for protection from a major snow storm that was developing [NIOSH 1990]. The woman separated from her husband to chase down a second flock of sheep. Shortly afterward, a high wind arose and created whiteout conditions in the area. The husband was unable to locate the woman and returned to the ranch to obtain additional help. At 10:00 p.m., the sheriff's department, local volunteer fire department, emergency medical service, and search and rescue units became involved in the search. The search continued until 3:00 a.m., when it was decided to wait for daylight. At 7:45 a.m., the body of the woman was found. Autopsy results showed she had died from hypothermia.

Recommendations

Whether in an indoor or outdoor environment where cold stress conditions are possible, employers and workers should be aware of symptoms of cold-related illness and injury, not only in themselves but also in their coworkers, and be prepared to immediately notify their supervisor, provide first aid, and seek prompt medical assistance (e.g., call 911).

Prevention is the best way to avoid cold-related illness and injury. Employers and workers should follow the NIOSH recommendations below to reduce the risk of cold-related illness and injury.

All Cold Environments

Employers should:

- Train supervisors and workers to prevent, recognize, and treat cold-related illness and injury.
- Provide training in a language and vocabulary that the workers understand.
- Reduce workers' time spent in the cold environment.
- Reduce the physical demands of workers (e.g., use relief workers or rotate extra workers in and out of work for long, demanding jobs).
- Ensure access to warm areas and a place to change out of wet clothes.
- Encourage employees to take breaks to warm up when needed.
- Monitor workers in cold conditions and initiate a buddy system.
- Include a medical and environmental thermometer and chemical hot packs in first aid kits.
- Participate in joint management/employee safety committees.
- Provide appropriate cold weather gear such as hats, gloves, and boots for work in cold environments.
- Provide wind protective clothing based on air velocities.
- Provide prompt medical attention to workers who show signs of cold-related illness or injury.

Workers should:

- Take regular breaks to warm up.
- Monitor their physical condition and that of coworkers.
- Stay hydrated by drinking lots of water; warm beverages may help increase body temperature.
- Stay well nourished by snacking on high carbohydrate foods.
- Avoid touching cold metal or wet surfaces with bare skin.

Photo by sorn340/Getty Images

- Report signs and symptoms of cold-related illness and injury to supervisors and medical staff immediately.
- Participate in joint management/employee safety committees.
- Carry extra cold weather gear, such as a change of clothes, in case work clothing gets wet.
- Wear several layers of loose clothing for better insulation; take layers off if you begin to sweat and put them back on when you cool down. Inner layers should be wool or synthetic fabrics to wick away moisture; outer layers should be wind and water-resistant.
- Avoid wearing wet clothes.
- Protect the ears, face, hands, and feet by wearing hats, gloves, socks, and boots.

Indoor Environments

Employers should:

- Install equipment to reduce drafts and condensation.
- Provide warm water or dry air heaters outside cold rooms for workers to warm their hands.
- Minimize air velocity and not exceed 200 FPM.
- Perform preventative maintenance on a regular schedule and make repairs if heating systems are not working properly.
- Rotate employees to different tasks after every break.
- Minimize work requiring manual dexterity in cold rooms.
- Provide glove alternatives for workers inside cold rooms (e.g., glove liners or fingerless gloves to wear under plastic gloves).

Photo by wabeno/Getty Images

Outdoor Environments

Employers should:

- Create a plan for assessing and acting on workplace hazards posed by sudden weather changes, such as dropping temperatures or increasing wind speeds.
- Schedule normal maintenance and repairs in cold areas for warmer months when possible.
- Schedule cold jobs for the warmer part of the day.
- Ensure that workers traveling through or working in remote areas have appropriate cold-weather survival equipment (e.g., emergency communications equipment such as a personal locator beacon or satellite phone).

Acknowledgments

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For More Information

Information about ***Cold Stress*** can be found on the following website:

https://www.cdc.gov/niosh/topics/coldstress/

1-800-CDC-INFO (1-800-232-4636)
TTY: 1-888-232-6348
CDC/NIOSH INFO: cdc.gov/info | cdc.gov/niosh
Monthly *NIOSH eNews*: https://www.cdc.gov/niosh/eNews.

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As part of the Centers for Disease Control and Prevention, NIOSH is the federal agency responsible for conducting research and making recommendations to prevent work-related illness and injuries. All ***Workplace Solutions*** are based on research studies that show how worker exposures to hazardous agents or activities can be significantly reduced.

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DHHS (NIOSH) Publication No. 2019-113

September 2019

OSHA® QUICK CARD™

How to Protect Yourself and Others

- Know the symptoms; monitor yourself and co-workers.
- Drink warm, sweetened fluids (no alcohol).
- Dress properly:
  - Layers of loose-fitting, insulating clothes
  - Insulated jacket, gloves, and a hat (waterproof, if necessary)
  - Insulated and waterproof boots

What to Do When a Worker Suffers from Cold Stress

For Hypothermia:

- Call 911 immediately in an emergency.
- To prevent further heat loss:
  - Move the worker to a warm place.
  - Change to dry clothes.
  - Cover the body (including the head and neck) with blankets, and with something to block the cold (e.g., tarp, garbage bag). Do **not** cover the face.
- If medical help is more than 30 minutes away:
  - Give warm, sweetened drinks if alert (no alcohol).
  - Apply heat packs to the armpits, sides of chest, neck, and groin. Call 911 for additional rewarming instructions.

For Frostbite:

- Follow the recommendations "**For Hypothermia**".
- Do not rub the frostbitten area.
- Avoid walking on frostbitten feet.
- Do not apply snow/water. Do not break blisters.
- Loosely cover and protect the area from contact.
- Do not try to rewarm the area unless directed by medical personnel.

For Trench (Immersion) Foot:

- Remove wet shoes/socks; air dry (in warm area); keep affected feet elevated and avoid walking. Get medical attention.

For more information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov (800) 321-OSHA (6742)

ATTACHMENT 9

Safety Data Sheets

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

1 Identification of the substance/mixture and of the supplier

1.1 Product identifier

Trade Name: Alconox
Synonyms:
Product number: Alconox

1.2 Application of the substance / the mixture : Cleaning material/Detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer	Supplier
Alconox, Inc. 30 Glenn Street White Plains, NY 10603 1-914-948-4040	Not Applicable

Emergency telephone number:
ChemTel Inc
North America: 1-800-255-3924
International: 01-813-248-0585

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments.

Hazard-determining components of labeling:
Tetrasodium Pyrophosphate
Sodium tripolyphosphate
Sodium Alkylbenzene Sulfonate

2.2 Label elements:

Skin irritation, category 2.
Eye irritation, category 2A.

Hazard pictograms:

Signal word: Warning

Hazard statements:
H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

Additional information: None.

Hazard description

Hazards Not Otherwise Classified (HNOC): None

Information concerning particular hazards for humans and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization : None

3.2 Description : None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 7758-29-4	Sodium tripolyphosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	12-28
CAS number: 68081-81-2	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	8-22
CAS number: 7722-88-5	Tetrasodium Pyrophosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	2-16

3.4 Additional Information : None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:

Maintain an unobstructed airway.

Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:

Wash affected area with soap and water.

Seek medical attention if symptoms develop or persist.

After eye contact:

Rinse/flush exposed eye(s) gently using water for 15-20 minutes.

Remove contact lens(es) if able to do so during rinsing.

Seek medical attention if irritation persists or if concerned.

After swallowing:

Rinse mouth thoroughly.

Seek medical attention if irritation, discomfort, or vomiting persists.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

4.2 Most important symptoms and effects, both acute and delayed

None

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents : None

5.2 Special hazards arising from the substance or mixture :

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information :

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures :

Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions :

Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up :

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections : None

7 Handling and storage

7.1 Precautions for safe handling :

Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.

7.2 Conditions for safe storage, including any incompatibilities :

Store in a cool, well-ventilated area.

7.3 Specific end use(s):

No additional information.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

8 Exposure controls/personal protection

8.1 Control parameters :

7722-88-5, Tetrasodium Pyrophosphate, OSHA TWA 5 mg/m3.

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance.

Eye protection:

Safety goggles or glasses, or appropriate eye protection.

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

9 Physical and chemical properties

Appearance (physical state, color):	White and cream colored flakes - powder	**Explosion limit lower:** **Explosion limit upper:**	Not determined or not available. Not determined or not available.
Odor:	Not determined or not available.	**Vapor pressure at 20°C**:	Not determined or not available.
Odor threshold:	Not determined or not available.	**Vapor density**:	Not determined or not available.
pH-value:	9.5 (aqueous solution)	**Relative density**:	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities**:	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water)**:	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature**:	Not determined or not available.
Evaporation rate:	Not determined or not available.	**Decomposition temperature**:	Not determined or not available.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

Flammability (solid, gaseous):	Not determined or not available.	**Viscosity**:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.
Density at 20°C:	Not determined or not available.		

10 Stability and reactivity

10.1 Reactivity : None

10.2 Chemical stability : None

10.3 Possibility hazardous reactions : None

10.4 Conditions to avoid : None

10.5 Incompatible materials : None

10.6 Hazardous decomposition products : None

11 Toxicological information

11.1 Information on toxicological effects :

Acute Toxicity:

Oral:

: LD50 > 5000 mg/kg oral rat - Product .

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Sodium Alkylbenzene Sulfonate: Causes skin irritation. .

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye irritation .

Tetrasodium Pyrophosphate: Rabbit - Risk of serious damage to eyes .

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.
Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.4 mg/l, 48 hours.
Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Tetrasodium Pyrophosphate: Fish, LC50 - other fish - 1,380 mg/l - 96 h.
Tetrasodium Pyrophosphate: Aquatic invertebrates, EC50 - Daphnia magna (Water flea) - 391 mg/l - 48 h.

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: ADR, ADN, DOT, IMDG, IATA	None	
14.2 UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA	None	
14.3 Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	**Class:** **Label:** **LTD. QTY:**	None None None

US DOT

Limited Quantity Exception: None

Bulk:	**Non Bulk:**
RQ (if applicable): None	**RQ (if applicable):** None
Proper shipping Name: None	**Proper shipping Name:** None
Hazard Class: None	**Hazard Class:** None
Packing Group: None	**Packing Group:** None
Marine Pollutant (if applicable): No additional information.	**Marine Pollutant (if applicable):** No additional information.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

	Comments: None	**Comments:** None
14.4	**Packing group:** ADR, ADN, DOT, IMDG, IATA	None
14.5	**Environmental hazards** :	None
14.6	**Special precautions for user:**	None
	Danger code (Kemler):	None
	EMS number:	None
	Segregation groups:	None
14.7	**Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:** Not applicable.	
14.8	**Transport/Additional information:**	
	Transport category:	None
	Tunnel restriction code:	None
	UN "Model Regulation":	None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable

Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

Germany MAK: Not classified.

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

HMIS: 1-0-0

Attachment B
Laboratory MDLs/RDLs

Apex Laboratories
Analytical Method Information

Ag (Silver) - 6020B - Total in Soil (EPA 6020B)

Method Header: Total Metals by EPA 6020B (ICPMS)

Container: 8 oz Glass Jar **Preservation/Storage:** 0-6 degrees C

Hold Time(s): Sampled to Analyzed: 180 day

Extraction Method: EPA 3051A

Prep Amounts: Initial Amt: 0.50 g Final Amt: 50.00 mL Standard Dilution: 10.00

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Silver	0.100	0.200	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Aluminum	25.0	50.0	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Arsenic	0.500	1.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Barium	0.500	1.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Beryllium	0.100	0.200	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Calcium	300	600	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Cadmium	0.100	0.200	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD

Reviewed By: _____ Date: ___/_____/_____

Apex Laboratories
Analytical Method Information

Co (Cobalt) - 6020B - Total in Soil (EPA 6020B)

Method Header: Total Metals by EPA 6020B (ICPMS)

Container: 8 oz Glass Jar **Preservation/Storage:** 0-6 degrees C

Hold Time(s): Sampled to Analyzed: 180 day

Extraction Method: EPA 3051A

Prep Amounts: Initial Amt: 0.50 g Final Amt: 50.00 mL Standard Dilution: 10.00

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Cobalt	0.500	1.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Chromium	0.500	1.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Copper	1.00	2.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Iron	25.0	50.0	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Mercury	0.0400	0.0800	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Potassium	50.0	100	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Magnesium	50.0	100	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD

Reviewed By: _____ Date: ___/_____/_____

Mn (Manganese) - 6020B - Total in Soil (EPA 6020B)

Method Header: Total Metals by EPA 6020B (ICPMS)

Container: 8 oz Glass Jar **Preservation/Storage:** 0-6 degrees C

Hold Time(s): Sampled to Analyzed: 180 day:

Extraction Method: EPA 3051A

Prep Amounts: Initial Amt: 0.50 g Final Amt: 50.00 mL Standard Dilution: 10.00

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Manganese	0.500	1.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Sodium	50.0	100	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Nickel	1.00	2.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Lead	0.100	0.200	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Antimony	0.500	1.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Selenium	0.500	1.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Thallium	0.100	0.200	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD

Reviewed By: _____ Date: ___/_____/_____

V (Vanadium) - 6020B - Total in Soil (EPA 6020B)

Method Header: Total Metals by EPA 6020B (ICPMS)

Container: 8 oz Glass Jar **Preservation/Storage:** 0-6 degrees C

Hold Time(s): Sampled to Analyzed: 180 day

Extraction Method: EPA 3051A

Prep Amounts: Initial Amt: 0.50 g Final Amt: 50.00 mL Standard Dilution: 10.00

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Vanadium	1.00	2.00	mg/kg		20	75 - 125	20	80 - 120	20

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Zinc	2.00	4.00	mg/kg		20	75 - 125	20	80 - 120	20

Reviewed By: _____ Date: ___/_____/_____

Apex Laboratories
Analytical Method Information

Total Organic Carbon - Soil (9060A) in Soil (EPA 9060Amod)

Method Header: Demand Parameters

Container: 4 oz Glass Jar **Preservation/Storage:** 0-6 degrees C

Hold Time(s): Sampled to Analyzed: 28 days

Extraction Method: PSEP-5310B TOC

Prep Amounts: Initial Amt: 0.20 N/A Final Amt: 0.20 N/A Standard Dilution: 1.00

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Total Organic Carbon	200	200	mg/kg		27			88 - 111	27

Reviewed By: _____ Date: ___/_____/_____

Apex Laboratories
Analytical Method Information

NWTPH-Dx (Diesel/Oil) in Water (NWTPH-Dx)

Method Header: Diesel and/or Oil Hydrocarbons by NWTPH-Dx

Container: 1 L Amber Glass - HCL **Preservation/Storage:** HCl to pH<2, 0-6 deg C

Hold Time(s): Sampled to Prepared: 14 days | Prepared to Analyzed: 40 days

Extraction Method: EPA 3510C (Fuels/Acid Ext.)

Prep Amounts: Initial Amt: 1,000.00 mL Final Amt: 5.00 mL Standard Dilution: 1.00

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Diesel	0.100	0.200	mg/L		30	59 - 115	30	59 - 115	30
Oil	0.200	0.400	mg/L		30				
surr: o-Terphenyl (Surr)	0.0200			50 - 150					

NWTPH-Dx (Diesel/Oil) in Soil (NWTPH-Dx)

Method Header: Diesel and/or Oil Hydrocarbons by NWTPH-Dx

Container: 8 oz Glass Jar **Preservation/Storage:** 0-6 degrees C

Hold Time(s): Sampled to Prepared: 14 days | Prepared to Analyzed: 40 days

Extraction Method: EPA 3546 (Fuels)

Prep Amounts: Initial Amt: 10.00 g Final Amt: 5.00 mL Standard Dilution: 1.00

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Diesel	10.0	20.0	mg/kg		30	73 - 115	30	73 - 115	30
Oil	20.0	40.0	mg/kg		30				
surr: o-Terphenyl (Surr)	1.00			50 - 150					

Reviewed By: _____ Date: ___/_____/_____

Apex Laboratories
Analytical Method Information

8270E LL PAH/PCP Only (Scan) in Water (EPA 8270E)

Method Header: Semivolatile Organic Compounds by EPA 8270E

Container: 1 L Amber Glass - Non Preserved **Preservation/Storage:** 0-6 degrees C

Hold Time(s): Sampled to Prepared: 7 days | Prepared to Analyzed: 40 days

Extraction Method: EPA 3510C (Acid Extraction)

Prep Amounts: Initial Amt: 1,000.00 mL Final Amt: 5.00 mL Standard Dilution: 1.00

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Acenaphthene	0.0100	0.0200	ug/L		30	47 - 122	30	47 - 122	30
Acenaphthylene	0.0100	0.0200	ug/L		30	41 - 130	30	41 - 130	30
Anthracene	0.0100	0.0200	ug/L		30	57 - 123	30	57 - 123	30
Benz(a)anthracene	0.0100	0.0200	ug/L		30	58 - 125	30	58 - 125	30
Benzo(a)pyrene	0.0100	0.0200	ug/L		30	54 - 128	30	54 - 128	30
Benzo(b)fluoranthene	0.0100	0.0200	ug/L		30	53 - 131	30	53 - 131	30
Benzo(k)fluoranthene	0.0100	0.0200	ug/L		30	57 - 129	30	57 - 129	30
Benzo(g,h,i)perylene	0.0100	0.0200	ug/L		30	50 - 134	30	50 - 134	30
Chrysene	0.0100	0.0200	ug/L		30	59 - 123	30	59 - 123	30
Dibenz(a,h)anthracene	0.0100	0.0200	ug/L		30	51 - 134	30	51 - 134	30
Fluoranthene	0.0100	0.0200	ug/L		30	57 - 128	30	57 - 128	30
Fluorene	0.0100	0.0200	ug/L		30	52 - 124	30	52 - 124	30
Indeno(1,2,3-cd)pyrene	0.0100	0.0200	ug/L		30	52 - 134	30	52 - 134	30
1-Methylnaphthalene	0.0100	0.0200	ug/L		30	41 - 120	30	41 - 120	30
2-Methylnaphthalene	0.0100	0.0200	ug/L		30	40 - 121	30	40 - 121	30
Naphthalene	0.0100	0.0200	ug/L		30	40 - 121	30	40 - 121	30
Phenanthrene	0.0100	0.0200	ug/L		30	59 - 120	30	59 - 120	30
Pyrene	0.0100	0.0200	ug/L		30	57 - 126	30	57 - 126	30
Pentachlorophenol (PCP)	0.100	0.200	ug/L		30	35 - 138	30	35 - 138	30
surr: 2-Fluorobiphenyl (Surr)				44 - 120					
surr: p-Terphenyl-d14 (Surr)				50 - 134					
surr: 2,4,6-Tribromophenol (Surr)				43 - 140					

Reviewed By: _____ Date: ___/_____/_____

Apex Laboratories
Analytical Method Information

8270E LL PAH/PCP Only (Scan) in Soil (EPA 8270E)

Method Header: Semivolatile Organic Compounds by EPA 8270E

Container: 8 oz Glass Jar **Preservation/Storage:** 0-6 degrees C

Hold Time(s): Sampled to Prepared: 14 days | Prepared to Analyzed: 40 days

Extraction Method: EPA 3546

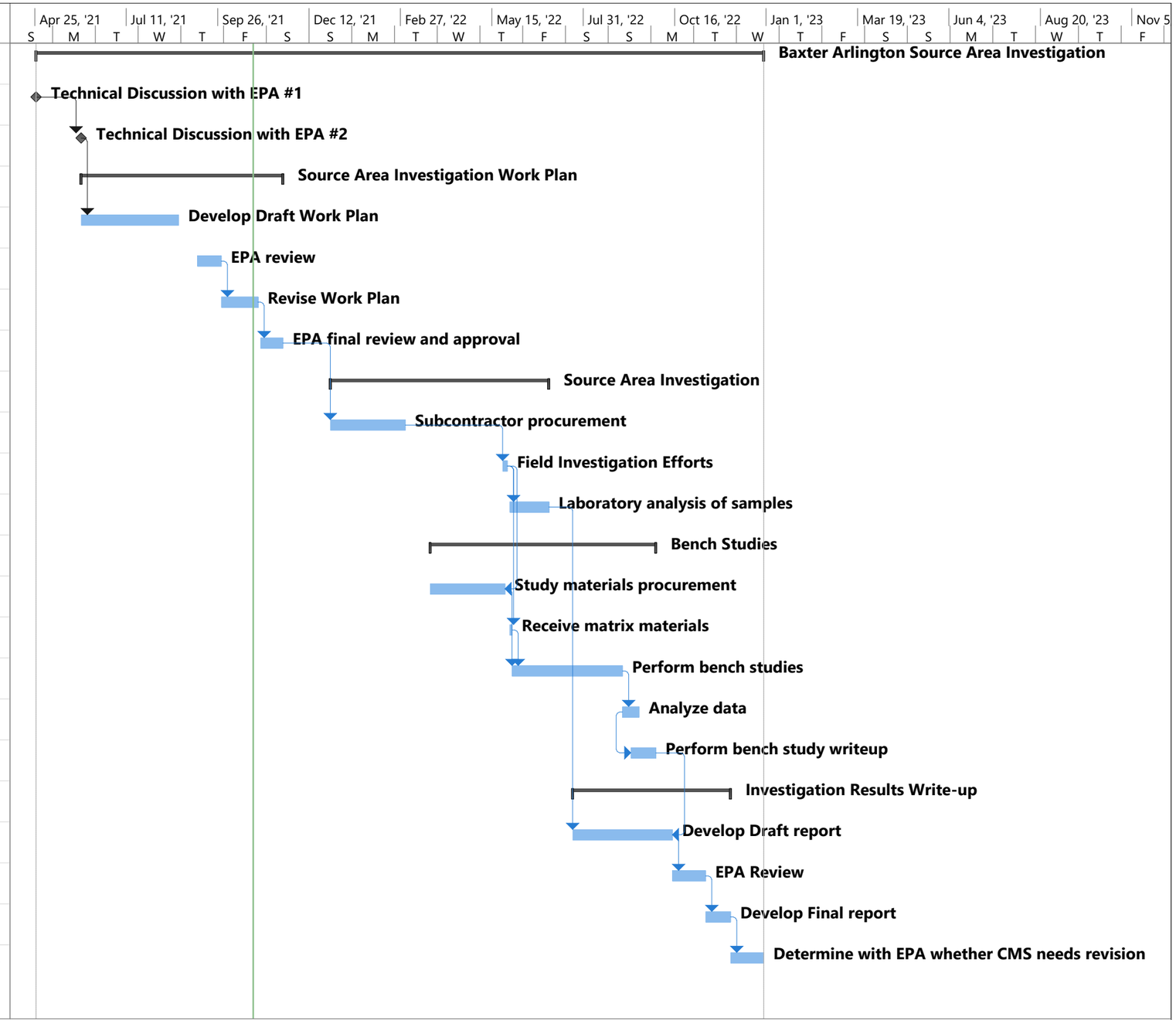
Prep Amounts: Initial Amt: 10.00 g Final Amt: 5.00 mL Standard Dilution: 1.00

Analyte	MDL	Reporting Limit	Units	Surrogate %R	Dup RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Acenaphthene	1.25	2.50	ug/kg		30	40 - 123	30	40 - 123	30
Acenaphthylene	1.25	2.50	ug/kg		30	32 - 132	30	32 - 132	30
Anthracene	1.25	2.50	ug/kg		30	47 - 123	30	47 - 123	30
Benz(a)anthracene	1.25	2.50	ug/kg		30	49 - 126	30	49 - 126	30
Benzo(a)pyrene	1.25	2.50	ug/kg		30	45 - 129	30	45 - 129	30
Benzo(b)fluoranthene	1.25	2.50	ug/kg		30	45 - 132	30	45 - 132	30
Benzo(k)fluoranthene	1.25	2.50	ug/kg		30	47 - 132	30	47 - 132	30
Benzo(g,h,i)perylene	1.25	2.50	ug/kg		30	43 - 134	30	43 - 134	30
Chrysene	1.25	2.50	ug/kg		30	50 - 124	30	50 - 124	30
Dibenz(a,h)anthracene	1.25	2.50	ug/kg		30	45 - 134	30	45 - 134	30
Fluoranthene	1.25	2.50	ug/kg		30	50 - 127	30	50 - 127	30
Fluorene	1.25	2.50	ug/kg		30	43 - 125	30	43 - 125	30
Indeno(1,2,3-cd)pyrene	1.25	2.50	ug/kg		30	45 - 133	30	45 - 133	30
2-Methylnaphthalene	1.25	2.50	ug/kg		30	38 - 122	30	38 - 122	30
Naphthalene	1.25	2.50	ug/kg		30	35 - 123	30	35 - 123	30
Phenanthrene	1.25	2.50	ug/kg		30	50 - 121	30	50 - 121	30
Pyrene	1.25	2.50	ug/kg		30	47 - 127	30	47 - 127	30
Pentachlorophenol (PCP)	12.5	25.0	ug/kg		30	25 - 133	30	25 - 133	30
surr: 2-Fluorobiphenyl (Surr)				44 - 120					
surr: p-Terphenyl-d14 (Surr)				54 - 127					
surr: 2,4,6-Tribromophenol (Surr)				39 - 132					

Reviewed By: _____ Date: ___/_____/_____

Attachment C
Estimated Schedule of Work

ID	Task Name	Duration	Start	Finish
1	**Baxter Arlington Source Area Investigation**	**439 days**	**Mon 4/26/21**	**Thu 12/29/22**
2	Technical Discussion with EPA #1	0 days	Mon 4/26/21	Mon 4/26/21
3	Technical Discussion with EPA #2	0 days	Wed 6/2/21	Wed 6/2/21
4	**Source Area Investigation Work Plan**	**122 days**	**Thu 6/3/21**	**Fri 11/19/21**
5	Develop Draft Work Plan	58 days	Thu 6/3/21	Mon 8/23/21
6	EPA review	14 days	Thu 9/9/21	Tue 9/28/21
7	Revise Work Plan	23 days	Wed 9/29/21	Fri 10/29/21
8	EPA final review and approval	15 days	Mon 11/1/21	Fri 11/19/21
9	**Source Area Investigation**	**132 days**	**Thu 12/30/21**	**Fri 7/1/22**
10	Subcontractor procurement	45 days	Thu 12/30/21	Wed 3/2/22
11	Field Investigation Efforts	4 days	Tue 5/24/22	Fri 5/27/22
12	Laboratory analysis of samples	25 days	Mon 5/30/22	Fri 7/1/22
13	**Bench Studies**	**136 days**	**Thu 3/24/22**	**Thu 9/29/22**
14	Study materials procurement	45 days	Thu 3/24/22	Wed 5/25/22
15	Receive matrix materials	2 days	Mon 5/30/22	Tue 5/31/22
16	Perform bench studies	67 days	Wed 6/1/22	Thu 9/1/22
17	Analyze data	10 days	Fri 9/2/22	Thu 9/15/22
18	Perform bench study writeup	15 days	Fri 9/9/22	Thu 9/29/22
19	**Investigation Results Write-up**	**95 days**	**Fri 7/22/22**	**Thu 12/1/22**
20	Develop Draft report	60 days	Fri 7/22/22	Thu 10/13/22
21	EPA Review	20 days	Fri 10/14/22	Thu 11/10/22
22	Develop Final report	15 days	Fri 11/11/22	Thu 12/1/22
23	**Determine with EPA whether CMS needs revision**	**20 days**	**Fri 12/2/22**	**Thu 12/29/22**



Project: Baxter - Arlington Site
Date: 10/26/2021

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone